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1904/05

Bulletins of THE MONTANA STATE COLLEGE OF AGRICULTURE *and* MECHANIC ARTS.

FOUNDED EIGHTEEN HUNDRED NINETY-THREE

Volume 3 *Numbers 1 to 8*

UNIVERSITY OF ILLINOIS

PRESIDENT'S OFFICE

Courses of Study and Register of Students.

Published Monthly by the College
During the College Year. . . .
1905--1906

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Entered April 14, 1904, at Bozeman, Montana, as Second Class Matter Under Act of Congress of July 16, 1894.

Bulletin of THE MONTANA STATE COLLEGE *of* AGRICULTURE *and* MECHANIC ARTS.

FOUNDED EIGHTEEN HUNDRED NINETY-THREE

Volume 3. *Number 3*

UNIVERSITY OF ILLINOIS

PRESIDENT'S OFFICE.

GENERAL INFORMATION

LIST OF STUDENTS

DEC. 1, 1904--DEC. 1, 1905.

Published Monthly by the College
During the College Year. . . .
DECEMBER 1, 1905

Entered April 14, 1904, at Bozeman. Montana, as Second Class Matter Under Act of Congress of July 16, 1894.

CALENDAR.

1905.

Thanksgiving Recess Ends	Monday, Dec. 4, 8;30 A. M.
Thanks giving Recess ends	Monday, Dec. 4, 8:30 A. M.
Winter Vacation begins	Saturday, Dec. 16.

1906.

Winter Vacation ends	Tuesday, Jan. 2, 8:30 A. M.
Examinations begins	Monday, Jan. 22, 9:00 A. M.
First Semester ends	Saturday, Jan. 27.
Second Semester begins	Monday, Jan. 29, 8:30 A. M.
Washington's Birthday, a holiday	February 22.
Winter Courses End	Friday, March 30.
Arbor Day, a holiday	
Visitor's Day	Friday, May 11.
Examinations begin	Monday, May 28.
Decoration Day, a holiday	May 30.
Examinations end	Friday, June 1.
Commercial Department Graduation	Saturday, June 2.
Baccalaureate Day	Sunday, June 3.
Domestic Science Department Graduation	Tuesday, June 5.
Commencement Day, Second Semester Ends	Wednesday, June 6.
Registration and Examination for Entrance and Conditions	Monday and Tuesday, September 10 and 11, 9 a. m.
First Semester begins	Wednesday, Sept. 12.
Winter Courses in Agriculture and Engineering begin	Tuesday, Nov. 13.
Thanksgiving Recess begins	Thursday, Nov. 29.
Thanksgiving Recess ends	Monday, Dec. 3.
Winter Vacation begins	Saturday, Dec. 22.

1907.

Winter Vacation Ends	Tuesday, Jan. 8.
Examinations Begin	Monday, Jan. 21.
First Semester ends	Saturday, Jan. 26.
Second Semester Begins	Monday, Jan. 28.
Washington's Birthday, a holiday	Friday, Feb. 22.
Winter Courses End	Friday, March 29.
Arbor Day, a holiday	
Visitor's Day	Friday, May 10.
Examinations Begin	Monday, May 27.
Commencement Day, Second Semester Ends	Wednesday, June 5.

MONTANA STATE BOARD OF EDUCATION.

Governor Joseph K. Toole, (ex-officio .... Helena.
Attorney General Albert J. Galen (ex-officio) .... Helena.
State Supt of Public Instruction, W. E. Harmon, (ex-officio) .... Helena.

BY APPOINTMENT.

John M. Evans .... Missoula.
Charles R. Leonard, ... Butte.
(Term expires February 1, 1906.)
N. W. McConnell .... Helena.
E. O. Busenberg .... Lewistown.
(Term expires February 1, 1907.)
O. P. Chisholm .... Bozeman.
Sidney D. Largent. .... Great Falls.
(Term expires February 1. 1908.)
G. T. Paul. .... Dillon.
Charles N. Kessler .... Helena.
(Term expires February 1, 1909.)

EXECUTIVE BOARD.

In Charge of the College and Experiment Station.

Peter Koch .... Bozeman.
(Term expires February 1, 1906.
Walter S. Hartman .... Bozeman.
(Term expires February 1, 1907.
John Maxey .... Bozeman.
(Term expires February 1, 1907.)
John M. Robinson .... Bozeman.
(Term expires February 1, 1908.)
E .B. Lamme .... Bozeman.
(Term expires February 1, 1909.

FACULTY.

JAMES M. HAMILTON, M. S., (Union Christian College) President.
Professor of Philosophy and Economics.
MRS. F. E. MARSHALL,
Professor of Art.
WILLIAM F. BREWER, A. M., (Harvard University.)
Professor of Latin and English.
AARON H. CURRIER, A. M., (Oberlin College.)
Professor of French and German.
MISS LILLA A. HARKINS, M. S., (South Dakota Agri. College.)
Professor of Domestic Science.
ROBERT A. COOLEY, B. S., (Massachusets Agri. College.)
Professor of Zoology and Entomology.
WILLIAM D. TALLMAN, B. S., (University of Wisconsin.)
Professor of Mathematics.
FREDERICK B. LINFIELD, B. S. A., (Ontario Agri. College.)
Professor of Animal Husbandry.
WILLIAM M. COBLEIGH, A. M., (Columbia University.)
Professor of Physics.
JOSEPH A. THALER, E. E., (University of Minnesota.)
Professor of Electrical Engineering.
GEORGE B. COUPER, M. E., (University of Minnesota.)
Professor of Mechanical Engineering.
VICTOR K. CHESNUT, B. S., (University of California.)
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E. TAPPAN TANNATT, B. S., (Washington State College.)
Professor of Civil Engineering.
WILLIAM J. ELLIOTT, B. S. A., (Ontario Agri. College.)
Professor of Dairying and Assistant in Animal Industry.
ALFRED ATKINSON, B. S. A., (Iowa State College.)
Professor of Agronomy.
ROY E. FISHER ,(University of Idaho.)
Assistant Professor of Horticulture.
CHARLES S. DEARBORN, B. S., (Kansas Agri. College.)
Assistant Professor of Mechanical Engineering in Charge of Shops.
HOMER G. PHELPS.
Principal of the Business Deparment.
MISS MARY A. CANTWELL.
Principal of the Preparatory Department.
MISS HELEN R. BREWER, A. B., (Iowa College.)
Instructor in History and Latin.
MISS EMMA STOCKINGER.
Instructor in Stenography and Typewriting.

MRS. MABEL KINNEY HALL, Ph. B., (Oberlin College.)
Instructor in Public Speaking and Assistant in Preparatory Dept.
EDMUND BURKE.
Instructor in Chemistry.
MISS FLORENCE BALLINGER.
Instructor in Sewing.
WYATT W. JONES, S. B., (Harvard University.)
Instructor in Botany.
HENRY C. GARDINER, M. D. C., (Chicago Vet. Col).
Instructor in Veterinary Science.
MRS. EDNA GAGE.
Assistant in Art.
F. ARTHUR OLIVER, (Toronto Conservatory of Music.)
Head of Piano Department.
MISS JOSEPHINE COOK, (Wooster Conservatory of Music.)
Head of Vocal Department.
GEORGE W. HEY, (Mus. Bac., Syracuse University.)
Instructor in Violin.
MRS. MARY K. WINTER,
Librarian.

STANDING COMMITTEES OF THE FACULTY.

AGRICULTURE—Linfield, Cooley, Chesnut, Fisher, Elliott, Atkinson.
ASSEMBLY—Hamilton, Mrs. Marshall, Miss Cook.
ATHLETICS—Tallman, Currier ,Atkinson.
COMMENCEMENT—Hamilton, Oliver, Currier, Mrs. Hall, Miss Cantwell.
ENGINEERING—Thaler, Couper, Cobleigh, Tannatt, Dearborn.
GENERAL SCIENCE—Cobleigh, Tallman, Brewer, Cooley, Miss Harkins. Chesnut.
LIBRARY—Hamilton, Cobleigh, Thaler.
PUBLICATION—Brewer, Cobleigh, Miss Cantwell, Cooley, Couper.
SCHEDULE—Tallman, Miss Cantwell, Linfield, Couper, Phelps.
STUDENT AID—Chesnut, Miss Harkins, Miss Cantwell, Elliott, Thaler.
STUDENT ORGANIZATIONS—Mrs. Hall, Currier, Brewer, Atkinson, Miss Brewer.

EXPERIMENT STATION STAFF.

F. B. LINFIELD,
Director and in charge of Animal Husbandry.
R. A. COOLEY,
Zoologist and Entomologist.
V. K. CHESNUT,
Chemist.
R. W. FISHER,
Horticulturist.
E. TAPPAN TANNATT,
Irrigation Engineer.
W. J. ELLIOTT,
Dairyman.
ALFRED ATKINSON,
Agronomist.
EDMUND BURKE,
Assistant Chemist.
FRANK W. HAM,
Assistant Chemist.

THE COLLEGE.

History and Endowment.

The College of Agriculture and Mechanic Arts is organized under an act of Congress of July 2, 1862. This act appropriated public land to the several states for the purpose of aiding in the maintenance of colleges, "where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the states may respectively prescribe in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life."

The State of Montana, by an act approved February 16, 1893, accepted and claimed the benefits and endowments provided under the acts of Congress of July 2, 1862, and August 30, 1890, the latter of which provides for the further endowment of the College.

The income of the College is derived from the proceeds of the sale and lease of public lands donated to the state by the federal government for the College, which amounts to 140,000 acres. An additional sum of $25,000 is appropriated for each year under the second Morrill act of August 30, 1890, "to be applied only to instruction in agriculture, the mechanic arts, the English language and the various branches of mathematical, physical, natural and economic science, with special reference to their application to the industries of life, and to the facilities for such instruction."

These funds, with the addition of the State appropriations and the fees of students, make a fairly liberal income.

Trustees—The general control of the institution is in the hands of the State Board of Education. The direct supervision is vested in an Executive Board of five members, appointed by the Governor, subject to the approval of the State Board of Education.

THE EXPERIMENT STATION.

In connection with the College, an Agricultural Experiment Station has been established. The object of this station is to further the interests of the agricultural industries of the State of Montana. This is done by conducting researches and experiments which may include the physiology of plants and animals; the diseases to which they are severally subject, with remedies for the same; the chemical composition of useful plants at their various stages of growth; the various subjects connected with irrigation; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soil and water; the chemical composition of manures natural or artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly upon the agricultural industry of Montana as may seem advisable. For the purpose of this important department, the United States government appropriates yearly the sum of $15,000, and for the years 1905-6 the State of Montana gives the sum of $6,000. The future development of the work will depend upon the increase of appropriations on the part of the State.

The station issues during the year a series of bulletins which put in practical form the results of the experimental work. These are sent, upon request, to any citizen of Montana who will apply for them, and any such may have his name entered upon a mailing list, and receive all bulletins as soon as issued. Address: Director Experiment Station, Bozeman, Mont.

GENERAL STATEMENT.

The Montana State College of Agriculture and Mechanic Arts is the state school of applied science. The purpose is to give the young men and women of Montana an opportunity to acquire a good college education in the lines provided by the law under which the institution is founded. The practical feature in instruction is emphasized, and, while the text book, recitation and lecture are employed, the student is required to put into practice as far as possible the instruction he receives. This is obtained by means of well equipped shops and laboratories. The work of the college is characterized throughout by a combination of theory and practice.

As it is a state institution, instruction is free to all residents of Montana of suitable age and acquirements. A small entrance fee is charged, to cover incidentals, and laboratory fees sufficient to cover the cost of material. The following departments and courses are maintained. The college publishes special pamphlets giving full description of each of these various forms of work and will send any or all of them to any address upon request to President James M. Hamilton, Bozeman, Montana.

I. A series of groups of studies leading to the degree of Bachelor of Science. These groups include in common a certain amount of foundation work in mathematics, language, science and history, and, at the end of the course, in philosophy and economics. Apart from the subjects required of all candidates for a degree, the student chooses one branch which he plans to make his specialty, and with this work takes a specified number of related subjects and elective courses, according to the prescriptions of his group and the counsel of his adviser. Groups of studies are arranged with each of the following subjects as a center: Biology, Chemistry, Domestic Science, Mathematics and Physics, History and Literature.

II. A course in agriculture leading to the degree of Bachelor of Scientific Agriculture. The college course in this subject is designed to give a scientific trainig for the agriculturist, and, at the same time, a broad and suggestive training for the citizen. In agriculture, the work is not intended to serve as a manual training course, but includes a large amount of technical matter that cannot be had on the farm. Special emphasis is laid, also, on the training of the faculties of observation, reason and judgment, to the end that the student may be open-minded toward his work and its possibilitites.

III. Courses in mechanical, electrical and civil engineering, leading to the degrees of Bachelor of Mechanical Engineering, Electrical Engineering or Civil Engineering.Each of these courses takes four years. The engineering courses are organized in the belief that thorough-going fundamental training is the first essential for a successful engineer, but that this fundamental training may be best secured in connection with a certain amount of study of the practical application of the principles involved, and not solely by theoretical study. It is, further, a leading thought that after the fundamental principles have been mastered, a certain amount of specialization in the main lines of engineering is advisable. It is the endeavor of this institution to combine a prudent amount of specialization in the closing years, with a thorough grounding in the fundamentals in the earlier portion of its courses; and in carrying out this plan it endeavors to make the mathematical and theoretical courses strong in the earlier years, and the applied courses continue progressively from the beginning to the end.

IV. A course in Art, covering four years. This work is intended to familiarize the student with the principles that underlie art, as well as with the practice of the various forms of art chosen according to the taste or talent of the student. Though lectures are given on the principles and history of art, the teaching is entirely individual. Among the forms of work offered are drawing, with attention to grouping, light and shade, perspective; clay modeling, wood carving, decorative designing, china painting, art embroidery, painting in oil or water colors, sketching from nature, figure study.

V. Preparatory courses—academic, agricultural and manual training and domestic economy—which admit to any college course. The academic course follows the lines laid down by the State Board of Education for admission to the science courses of the State Institutions. The agricultural and manual training and domestic economy courses substitute for the language and science work of the academic course, technical subjects for their special purposes. These courses present special features not found in the high schools of the state. For entrance the students shall be at least thirteen years of age and shall have finished the work requisite for admission to the ninth grade, or to the high school. Applicants for admission will be required to pass an examination or otherwise satisfy the faculty of their proficiency before entering any classes.

VI. Courses in business training, given by a specially organized department. For entrance to this work students should have a common school education. The department offers training in bookkeeping and business practice, and in stenography and typewriting. In neither of these courses can the work required for graduation be completed in less than a year. The length of time necessary varies with the training, talent and application of the individual student. Students are not allowed to pursue both the bookkeeping and shorthand courses at the same time.. The business department has a full and adequate equipment for its work and its thoroughly trained graduates have little difficulty in getting into good positions.

VII. A one year course in domestic science, which also includes some elective work in other subjects. This course provides work in sewing, cooking, and household economy and sanitation.

VII. Two-year winter courses in agriculture and engineering, beginning each year about November 10th and ending about April 1st. The course in agriculture is destined to meet the wants of those who wish to make a more practical study of agriculture and who cannot remain throughout the entire college year. The work has been planned to give the largest amount of information and assistance possible. The subjects taught are those of which every farmer should have a full and clear knowledge, and are presented in a manner to make the information helpful in the highest degree. This course coming, as it does, in the winter, when the work on the farm is at a minimum, presents the best opportunity for the farmer to avail himself of the instruction given.

The winter course in engineering, like that in agriculture, is intended for those who cannot get time for the regular four years' courses. A large amount of practical work is included in steam engine management, shop work and mechanical drawing.

IX. Courses are provided in instrumental music, including both the piano and violin; and in vocal music.

In the study of the piano, special attention is given to thorough technique, correct interpretation, touch and phrasing, and use of the pedal. For advanced students, theory, analysis and history of music is also required. Frequent recitals will be given by the students, so that confidence, ease and grace may be acquired in performing before an audience.

A violin department has recently been organized, with Prof. G. W. Hey as instructor. Prof. Hey is a graduate of Syracuse University, New York and has also studied in Berlin, Germany. In this department the course of instruction will vary according to the needs and ability of the student; but it will be the aim to lay a broad and solid foundation upon which can be built up an artistic technique and an intelligent style, which will fit the student for concert work and for ensemble playing.

In the study of vocal music the formation and development of the singing voice wil be carried forward by the adoption of what are believed to be the best features of several methods, as well as by the use of discriminating judgment as to any particular needs of the particular voice under treatment. Special attention will be given to breath control and tone placement; the proper use of the muscles of the throat and tongue.

MATERIAL EQUIPMENT.

Location.

Bozeman is on the main line of the Northern Pacific railway, near the eastern extremity of the Gallatin valley. It is the county seat of Gallatin county and, according to the census of 1904, it has a population of over five thousand. Southwest of the city, but still within the city limits, on a slight elevation are the grounds and buildings of the college and experiment station. They command a view of one of the most fertile valleys in the world, covered far and wide with great fields of grain; and hemmed in on every side by the minor ranges that form the eastern spur of the Rockies. The rich lowlands and almost equally fertile benchlands; the mountain slopes, wildly rocky or covered with forests; the canyons, widening and narrowing, traversed by clear and rapid mountain streams—all these offer a rich and varied field for the naturalist scientist, and are a source of constant delight to all who care for nature.

The Campus and the Farm.

The grounds and farm now contain about two hundred and thirty acres. Of this over sixty acres in the immediate vicinity of the buildings constitute the campus and recreation grounds. The remainder is devoted to farming and experimental purposes.

Buildings.

College Hall, situated in the center of the college campus, is a substantial structure of brick and stone, of practically fireproof construction, having a total length of one hundred and twenty-eight feet and a width of ninety feet. It is three stories high and has a basement, which furnishes quarters for the Domestic Science department and two class rooms. The first floor contains the library, four offices and three large class rooms. The north half of the second floor is devoted to the Art department, the arrangement being such that the three large rooms can be thrown together, by sliding doors, for exhibition purposes. The south half of this floor is fitted up entirely for the use of the Business department, and arranged like the best business colleges. The third floor contains the large assembly hall, two draughting rooms, and five class and music rooms. The building is well lighted and commands a magnificent view of the Bridger and Gallatin mountains and the whole of the beautiful Gallatin valley. The whole building is lighted with electricity from the generator in the power house.

The Chemistry and Physics Building is located west of the College hall. It is built of pressed brick and has two observatory towers, one at each end, and is three stories high, including the basement. The basement is occupied by the physics lecture room, the mineralogical and assay laboratory and by the museum of geology and mineralogy. In addition to these are rooms for the preparation of samples for analytical work, with crushing and grinding machinery. The main floor is occupied by the office and department library, a lecture room, a preparation room, a small class room, and the Experiment station laboratory. The second story contains the laboratories for physics, the qualitative laboratory and the quantitative laboratory. The north tower is used for a meteorological observatory, and a fine set of registering instruments is installed in it.

The Shop Building is a one story frame structure sixty by one hundred feet, situated back of College Hall, and contains a machine shop forty-four by seventy-two feet, a forge shop twenty-seven by sixty feet, office, tool room and wash room.

The Engineering Laboratory is a two-story stone building, thirty-three by fifty two feet, located two hundred and sixty feet east of the shop buildings, and receives its steam supply from the main boilers through underground piping. In this building are housed the departments of electrical and civil engineering.

The Experiment Station building, consisting of three stories and a basement, is brick veneered and is situated on the west end of the campus adjoining the Experiment farm. The upper two floors are occupied by the Biology department. On the top floor is a small lecture room equipped with electric lantern, a musuem containing the herbarium and zoological collections, and a small room for work in bacteriology. On the floor below are three laboratories for work in botany and zoology, the office of the entomologist and a private work room. The first floor is occupied by the director's offices, station library and the class room, laboratory and office of the horticulturist. The basement is used by the department of Agronomy and has the following rooms: Office, class room, store room, soil laboratory and seed laboratory. Immediately south of this building is an Insectary, ten by eighteen feet, used for the study of living insects.

The Dairy Building is a two-story frame structure, with a one-story wing, twenty by forty feet. On the first floor are the butter and cheese-making rooms, store rooms and offices. In the wing are the boiler and engine room, fuel room and ice house. On the second floor are a milk-testing laboratory and a class room.

The Poultry Buildings include two main buildings one seventy-two by sixteen feet, with twelve pens; the other one hundred and twenty-eight feet long, with eight pens; with yards one hundred feet long on either side, and a brooder house, thirty-six by sixteen feet. These buildings are connected by a feed room, fourteen by twenty feet, under which is an incubator cellar and a heating plant for the building. They are south of the experiment station building.

The Seed Barn and Granary is a two-story frame building, situated opposite the horse stable. It affords storage room for the field crops, and for the experimental grains and seeds grown on the station farm.

The Cattle Barn is a two-story frame building with two wings extending to the south. One of these wings is used for the dairy cows and breeding stock, and the other for bulls, young stock and calves. Between these two rooms is located a stock-judging room forty feet square. The second story of the main barn is used for the storage of hay. The first story provides feeding rooms, storage for grain and box stalls.

The Horse Barn, a two-story building, situated west of the Experiment station building, provides accommodation for thirteen horses, as well as sufficient room for the storage of a considerable quantity of feed.

The Piggery consists of a main building thirty by thirty-five feet, with two wings sixteen by fifty feet each. In the main building are the feeding rooms and slaughter room, while the wings provide six pens each, or twelve pens altogether, for the hogs.

The Greenhouses are two wooden framed structures twenty by forty feet each, one supported on a brick foundation and wall, and the other on a wooden foundation with board walls. These are situated east of the station building.

The Drill Hall is a one-story frame structure situated just west of the chemical building, which has recently been provided with a wooden floor and made suitable for athletic and military purposes. It affords an excellent place for practice of athletic sports of various kinds, especially basket ball.

The Power House is a brick structure, thirty-two by seventy-six feet, centrally located with reference to the principal college buildings. It contains an eighty horse-power return tubular boiler, a one hundred and twenty-five horse-power Root water-tube boiler, a sixty-horse power "Imperial" engine, directly connected to a forty K. W. commercial dynamo, and large coal storage bins, while the engine and generator furnish power for driving the ventilating fans, the shop and laboratory machinery.

The Station Heating Plant is a neat brick structure just west of the station building, which furnishes the steam heat for the buildings grouped about the station.

EQUIPMENT.

Chemistry—The lecture room is equipped with a portlumiere, for use in experiments requiring projection. When cloudy weather interferes with the use of the portlumiere, the electric arc lamps or the oxyhydrogen lantern may be used for projection, all these instruments being arranged so as to be interchangeable. A lecture desk extends across one end of the room, and is supplied with water, gas and electricity, and with a hood, which permits the making of experiments with which objectionable odors are associated. A sufficient amount of apparatus has been secured to illustrate all of the important laws and phenomena of chemistry. The laboratory for qualitative analysis, besides desks and fume closets, has a large desk for special operations, every requisite for successful work being supplied. In quantitative analysis, the students may draw from the supply room any apparatus they may require for their work, consisting of platinum crucibles, dessicators, measuring flasks, pipettes, beakers, flasks ,burettes, reagent bottles, stoves, etc. One corner of this room is separated from the remainder by a sash partition, and serves for the balance room.

In addition to the standard reference books in science, and the principal books in its different branches, the department library contains the folowing complete files of scientific journals: American Journal of Science, Journal of the American Chemical Society, Journal of Analytical and Applied Chemistry, Berzelius' Jahresbericht, Jahresbericht ueber die Fortschritte der Chemie, etc.; Berichte der deutschen Chemischen Gesellschaft, and many sets, more or less complete, of other journals.

Physics—The lectures and recitations in physics are held in a room specially provided with the usual conveniences for giving experimental illustrations of the science. A careful selection of imported apparatus for lecture demonstrations has been secured. There is not sufficient available space here to enumerate individual pieces.

For laboratory instruction three well-lighted and conveniently furnished rooms are provided. The laboratory equipment includes the following, viz: Micrometer and vernier gauges, spherometer, cathetometer, balances and weights, hydrometers, Atwood's machine, Young's modulus apparatus, torsion apparatus, torsion pendulums, apparatus for resolution and composition of forces, harmonic motion, principle of moments, centrifugal force, and surface tension; simple, and Kater's pendulums, a laboratory clock, thermometers, calorimeters, expansion apparatus, hygrometers, Searles' mechanical equivalent of heat apparatus, magnetometer, electrodynamometer, ammeter, voltmeter, galvanometers as follows: tangent, astatic, Thompson, differential, Northrup and four forms of D'Arsonval, standard resistances and condenser, Carhart-Clark cells, wire and box forms of Wheatstone bridge, Carey Foster bridge, rheometer, Leeds' potentiometer, photometer, spectrometer, spectroscope, mirrors, prisms, lenses, diffraction grating, Fresnel mirror and bi-prism, apparatus for polarized light, sonometers, Kundt's tubes, siren, Lissajous apparatus and Helmholtz resonators.

Biology—The biological laboratories, on the second floor of the experiment station building, are fitted to accommodate about fifty students. The apparatus available for work in botany and zoology consists of twenty-five compound microscopes, five of high power for bacteriological work; a Filar micrometer; two microtomes; electrically heated paraffin bath; twenty-five dissecting microscopes and the necessary reagents and apparatus, for histological and physiological botany; and the necessary apparatus for the histology of animal tisues, dissecting instruments, and other apparatus for laboratory study of animal types. The department owns a large and growing collection of models and charts for illustrative purposes. A valuable collection of histological mounts has been gathered from various sources, a large part of them having been made in the department.

The department has purchased the entomological section of the Concilium Bibliographicum and is a subscriber to the additional cards. This catalogue and one of about 35,000 references, made by the department, is of great service in facilitating the library work of the students in entomology.

The Botanical Library, for reference and use in systematic work contains about 3,000 volumes, including the Kew Index, Sargent's Silva, Eaton's Ferns, DeCandolle's Prodromus, Engler & Prantl's Pflanzenfamilien, Saccardo's Sylloge Fungorum, DeToni's Sylloge Algarum, Wolle's Diatoms, Desmids and Fresh-water Algae, and most of the more recent and important monographs pertaining to American botany, while the leading botanical periodicals are kept on file in the college library. Almost all the books and pamphlets relating to the Rocky Mountain botany are available for student use. These works of reference and the valuable herbarium of named specimens offer unusual facilities for study and research into the distribution, adaptations and economic possibilities of this most interesting flora.

Animal Industry—Lectures on this subject are given in the class room in the dairy building. For this work charts illustrating different types of animals and giving the composition of various plant and animal products, are used. Several hundred lantern slides, illustrative of the various types and breeds of cattle, sheep, horses and hogs, are, by means of a good stereopticon, used to illustrate this work.

The work in stock judging is given in the class room in the cattle barn. For this work there is available a herd of twenty-five dairy cows, a small herd of pure bred cattle, Herefords and Shorthorns, the farm horses, some pure bred hogs,—Berkshire, Poland China and Yorkshire—and a few head of sheep. During the winter season the live stock used in the feeding experments is also available for study. For the poultry work some five or six breeds of chickens are kept.

Dairying—In the college dairy is the butter and cheese making laboratory. Cream separators of four different styles are provided for the use of the student. Cream and milk vats, churns of different styles, butter worker, cheese vats and cheese presses provide facilities for illustrating all phases of the work in butter and cheese making. Steam and power are provided by a ten horse-power boiler and eight horse-power engine. The milk testing laboratory, also in the dairy building, is equipped with two steam turbine Babcock milk testers, and all kinds of glassware used with such milk testers. The various acid, rennet and fermentation tests used in dairy work are also kept on hand.

Horticulture—The orchard, consisting of about five hundred trees, representing many varieties of apples, plums, pears and cherries; the nurseries, in which are growing ornamental trees and shrubs; the small fruit plantation, representing varieties of strawberries, raspberries, etc.; the vegetable gardens, in which are grown each year many different kinds and varieties of vegetables; the greenhouses and the representative collection of greenhouse plants, afford good facilities for studying horticulture in its many different phases.

Agronomy—The lectures and recitations in agronomy are held in the lecture room on the first floor of the experiment station building. For laboratory work, a large room just adjoining the class room is used. In addition to these, a room for the storing of apparatus and class room material is devoted to this work. The apparatus for laboratory work, particularly in soil physics, has been carefully selected and is modern in every particular. There is now an adequate soil laboratory equipment, so that the facilities for class room and investigation work in soils are especially good. This equipment includes several kinds of special apparatus designed to illustrate all the physical phenomena resulting from or accompanying cultivation.

For laboratory work in farm crops, a large quantity of material from the field investigation work has been accumulated and is used in the study of the crops of the farm. Different makes of all classes of farm machines are provided, and these are used for demonstration purposes in the lecture on farm machines.

Shopwork—The equipment for this work consists of the latest patterns of standard machines from the best makes in the country. Power is furnished by a fifteen horse-power electric motor.

For bench work in wood there are provided twenty benches and twenty-six complete sets of the best grade of carpenter's tools, besides many special tools. For wood turning and pattern making there are eight speed lathes, a pattern making lathe, a scroll saw, a double revolving rip and crosscut saw, a variety wood-worker, a twenty-inch surface planer, a band saw and a wood trimmer.

For machine work there are four screw cutting lathes of sixteen-inch swing, and one eighteen-inch swing; thirteen-inch, twenty-inch and twenty-eight-inch drill press; a universal milling machine, a sixteen-inch shaper, a twenty-two inch by twenty-two inch by six foot planer, a universal tool grinder, a cutter and reamer grinder, a twist drill grinder, a polishing lathe, a power hack saw and a pipe threading machine. Benches for twelve students are provided. There is also room for additional equipment, as the needs may develop. The tool room is well supplied with small tools.

The forge room contains eleven power forges and a portable hand forge. All the piping, for both blast and exhaust, is of tile, and placed under the floor. The forges have down draft exhaust, keeping the room free from smoke and giving a very neat appearance. There is a full equipment of anvils and other necessary tools, a power shear for cutting up stock, and a fifty-pound power hammer. A brass furnace and core oven have been added; also moulding tools for use in brass founding. A wash room and lockers are provided for student use.

The Engineering Laboratory contains at present, for mechanical work, a forty-horse-power high speed engine, designed especially for experimental work; a fifteen-horse-power, vertical high speed engine; a fifty-horse-power surface condenser; a fifteen-horse-power Advance compound traction engine; a sixteen-horse-power Russell traction engine, gauges, calorimeters, indicators, absorption brakes, several sizes of platform scales, tachometers, and similar apparatus for the study of steam engineering. The Imperial engine and the eighty-five horse-power water tube boiler are also fitted up for experimental work. Apparatus is provided for measuring feed water, and everything necessary for complete boiler tests.

For the testing of materials there is a Riehle standard automatic and autographic screw power testing machine of 100,000 pounds capacity, with auxilliary instruments, fitted up also for beam testing; an Olsen torsion testing machine, capable of breaking a specimen one and one-half inches by five feet .

For electrical work, the college owns two specially designed double current multipolar generators of fifteen kilowatts capacity. They are arranged to deliver direct current at one hundred and sixty volts, or single, two or three-phase alternating current of sixty frequency; the two machines thus give a large variety of combinations. Besides, there are a six kilowatt bipolar, an eight kilowatt multipolar, and a fifteen light arc dynamo; a six horse-power three-phase motor; a fifteen horse-power multipolar motor, a five horse-power bipolar motor, a storage battery consisting of cells of various types, and a good supply of rheostats, voltmeters, ammeters and wattmeters of the latest patterns; a Willyoung photometer for testing the power of incandescent lamps; a Cooper-Hewitt mercury vapor lamp, a Leeds potentiometer, a Kelvin balance for calibrating instruments, and a number of high tension insulators and wires. A collection of various types of raising and lowering transformers furnish facilities in that line, while a large lamp bank furnishes a ready means of obtaining loads. Power is furnished either from the service generator in the power house or from the Woodbury engine in the laboratory.

Civil Engineering—In this department the college has two transits, both with solar attachments; three engineers' levels; two plane tables with alidades, declinators, etc.; a sextant; artificial horizon; planimeters; calculating instruments; railway and irregular curves; chains; tapes; level and stadia rods; pocket level; office drafting instruments; drafting tables and office equipment. Water measuring instruments include four current meters of different makes and design, seven automatic water registers, test weirs, hook gages and other auxilliary apparatus. The cement testing laboratory is provided with a Fairbanks cement testing machine, sieves, briquette molds, etc.

The Kitchen Laboratory has two large rooms, provided with cupboards and conveniently furnished with tables, sinks, ranges, an Aladdin oven and a good supply of cooking utensils of all kinds. Individual work tables are provided for the use of each student. These tables have a full equipment of cooking utensils. Opening from the kitchen is a dining room, with sideboard well supplied with table linen, dishes and silver.

The Sewing Room is furnished with large cutting tables, small sewing tables, seven sewing machines, dress forms, dress boxes and cases for work. The Domestic Science rooms are fitted up in home fashion, with rugs, pictures, etc., and are used for receptions and other social gatherings.

The Art Department has a good equipment of casts in busts, masks, parts of the human figure, ornament and geometric solids; benches and tools for wood carving and clay modeling, a kiln for firing china, a perforating machine for transferring designs for embroidery, and photographic copies of sculptures and world pictures.

MUSEUMS AND HERBARIUM.

The Herbarium now contains about 15,000 sheets of Montana species, some 5,000 from other parts of the United States, and 800 species from India. Among these are Kelsey World's Fair collection of 1,150 specimens, set of the Tweedy collection of Montana species, the entire Williams' Herbarium of some 1,200 specimens, exclusive of duplicates, the Rydberg-Bessey collection of about 600 specimens, the Koch Herbarium of some 1,200 specimens, the Elrod collection of 1897, containing about 225 specimens, and many smaller collections from various parts of the state. Of Cryptogams, our Herbarium now contains Cummings, Williams and Seymour's Lichenes Boreali Americani (250 specimens), Renauld & Cardot's Musci Europaei (250 specimens), Collins, Holden & Setchell's Phycotheca Boreali Americana (850), Seymour & Earle's Economic Fungi

(500), Ellis & Everhart's Fungi Columbiani (1,400), a private collection of about 400 Characeae, and several hundred other specimens from Montana. A large number of duplicates afford abundant material for exchange and for the use of students in advanced systematic work, while the greenhouse of the experiment farm furnishes specimens for winter study.

The Museum of Geology and Mineralogy occupies a part of the lower floor of the chemical building. The collections in mineralogy and geology are very extensive and cover all the geological horizons, being particularly rich in minerals of economic importance. The collection exhibited by Montana at the Columbian Exposition was presented by the state to the college, and gives an excellent view of our state's mining resources. A very large amount of duplicate material is constantly being used to increase our collections through the medium of exchange. Two sets of crystal models, and the crystallized specimens in the collection are available for instruction in crystallography. Collections in economic geology and applied chemistry are being made, and the material already in hand has proved very valuable for illustrative purposes. The Educational Series of Rocks, with thin sections for study under the microscope, is an important part of the equipment. Montana conditions are particularly well represented by these collections, and frequent reference is made to the contents of the musuem by those interested in our mineral resources. A card catalogue of the specimens is a great aid in their study.

The Zoological Museum contains a collection of vertebrate and invertebrate animals in alcohol and formalin, brought together from various sources for illustrative purposes in lecture work. About one hundred and twenty species of Montana birds are represented by skins and mounts. A collection of mounted skeletons is available for comparative work in vertebrate anatomy. About thirty thousand insect specimens have been collected from all parts of Montana. From these a systematic reference collection is being built up. It now contains about 2,500 named species.

LIBRARY AND READING ROOM.

These are two large and well lighted rooms on the first floor of College Hall. The library contains about 8,050 well selected books and about 6,000 pamphlets. It shelves are well supplied with the standard works in history, science and literature. About twelve hundred dollars is spent yearly on books and magazines. The following periodicals are to be found in the reading room:

American Blacksmith.
American Chemical Journal.
American Electrician.
American Geologist.
American Historical Review.
American Houses and Gardens.
American Journal of Mathematics.
American Journal of Pharmacy.
American Journal of Science.
American Machinist.
American Veterinary Review.
Analyst.
Anatomischer Anzeiger.
Annals of Botany.
Annals of Mathematics.
Atlantic Monthly.
Berichte der Deutschen Chemischen Gesellschaft
Bio-chemische Centralblatt.
Bon Ton.

Bookkeeper.
Boston Cooking School Magazine.
Botanical Gazette.
Botanisches Centralblatt.
Breeders' Gazette.
British Gardening.
Bulletin of the Torrey Botany Club.
Canadian Entomologist.
Cassier's Magazine.
Century Magazine.
Chemical News.
Chicago Dairy Produce.
Cosmopolitan.
Country Gentleman.
Country Life.
Crelle's Journal of Mathematics.
Critic.
Delineator, The
Dial.
Dietetic and Hygienic Gazette.
Die Elektrotecknische Zeitung.
Education.
Educational Review.
Electrical World and Engineer.
Electrician (London).
Engineering and Mining Journal.
Engineering Magazine.
Engineering News.
Entomological News.
Entomological Monthly Magazine.
Farmers' Advocate.
Fliegende Blaetter.
Forum.
Gardener's Chronicle.
Good Housekeeping.
Harper's Bazaar.
Harper's Magazine.
Harper's Weekly.
Heating and Ventilation.
Hoard's Dairyman.
Illustration.
Intercollegian.
International Quarterly.
Iowa Homestead.
Irrigation Age.
Journal of the Institute of the Electrical Engineers.
Journal of New York Entomological Society.
Keramic Studio.
Ladies' Home Journal.
Library and Literary News.
Library Journal.
Literary Digest.
Locomotive Engineering.
London Live Stock Journal
Machinery.
McClure's Magazine.
Modern Housekeeping.
Modern Language Notes.
Modern Priscilla.
National Geographic Magazine.
New York Produce Review.
Nineteenth Century.
North American Review.
Northwest Poultry Journal.
Orange Judd Farmer.
Outing.
Outlook.
Pattern Maker.
Philosophical Magazine, British.
Physical Review.
Popular Science Monthly.
Power .
Pysche.
Publishers' Weekly.
Quarterly Review.
Records of the Past.
Reliable Poultry Journal.
Review of Reviews.
School Science and Mathematics.
Science.
Science Abstracts, Secs. A and B.
Scientific American Supplement.
Scribner's.
Street Railway Review.
Success.
Table Talk.
Technical World.
Typewriter and Phonographic World
Ueber Land und Meer.
Wallace Farmer.
Western Electrician.
What to Eat.
World's Work.
Youth's Companion.
Zeitschrift fur Analytische Chemie.
Zoological Record.
Zoologische Anzeiger.

The following perodicals are donated:

Bulletin of the Bureau of Labor.
Climate and Crop Service, Mont. Sec.
Department of Labor.
Experiment Station Record.
Farm and Voice.
Farmer.
Industrialist.
Indiana Farmer.
Monthly Weather Review.
National Stockman and Farmer.
Northwest Agriculturist.
Patent Office Gazette.
School of Mines Quarterly.

The following newspapers are also to be found in the reading room. Most of them are donated:

Anaconda Standard.
Basin Progress.
Belt Valley Times.
Big Timber Pioneer.
Bozeman Chronicle.
Butte Inter-Mountain.
Butte Evening News.
Dillon Tribune.
Farm and Floral World.
Farmers' Voice
Fergus County Argus.
Forsyth Times.
Great Falls News.
Helena Independent.
Illinois Staats Zeitung.
Inter Lake.
Landwirthschaffliche Beitrage.
Madisonian.
Meagher Republican.
Montana Daily Record.
Montana Homestead.
Montana Sunlight.
Phillipsburg Mail.
Red Lodge Picket.
Republican-Courier.
Rocky Mountain Husbandman.
Rosebud County News.
Salt Lake Tribune.
Townsend Messenger.
Townsend Star.
The Times.
Tri-County News.
Westen und Daheim.
Western News.
Wochenblatt der N. Y. Staats Zeitung

GENERAL INFORMATION.

FEES.*

Annual matriculation fee for college courses, preparatory or business departments, or one year course in domestic science	$12.00
Annual matriculation fee for winter courses in agriculture or engineering	4.00

DEPOSITS.*

Agriculture, dairying, soil physics or soil fertility, per semester	$ 2.00
Art, preparatory or college courses, or art course per year	1.00
Botany, preparatory or college courses, per semester	1.00
Bacteriology, per semester	4.00
Business department, bookkeeping, per year	3.00
Typewriting, per year	9.00
Chemistry, freshman, per year	8.00
Quantitative, organic, physical, toxicology, or mineralogy, per semester	10.00
Assaying, per semester	20.00
Domestic science, preparatory or college, per year	1.50
One year course, per year	3.00
Specials, per year	3.00
Sewing, per year	50

*A fee is a fixed charge and no part of the fee is returned to the student. The deposits are intended to cover the cost of the materials and equipment in the laboratory and any balance of the deposit not required for this purpose is returned to the student at the close of the course.

Engineering, college shop courses, per year	6.00
Preparatory shop courses, per year	3.00
Laboratory, per semester	3.50
Surveying, per year	1.50
Winter course, first year	5.00
Physics, preparatory, per year	1.00
College, per year	2.00
Zoology, college, per semester	1.50
Histology, per semester	4.50

General Expenses.—The total expenses for the year may be estimated at $200.00 or upwards. Thre are no dormitories connected with the college. Students can find room and board in private families. Good homes can be obtained at very reasonable rates. Board and room may be had for seventeen dollars per month and upwards. Students may lessen expenses by forming clubs.

Requirements for Admission.—Candidates for the freshman class, in any of the college courses, must be graduates of the preparatory department or of an accredited high school, or must pass a satisfactory examination upon the subjects included in the requirements of the state board of education for accredited high schools. Candidates for admission to the preparatory department, business department or the one year course in domestic science, should have completed the work of the eighth grade. For admission to winter courses in engineering and agriculture, there are no set requirements, all being admitted who give any evidence of being able to profit by the work.

Registration and Assignment of Work.—All students are registered in the president's office, and each one is then assigned to a member of the faculty, called the class officer. The class officers arrange the studies and it is their duty to advise with the students regarding all questions which arise in connection with their studies and to investigate complaints of unsatisfactory work. Students should consult with the class officers when in need of assitance or information.

Amount and Regularity of Work.—Students under twenty-one years of age will be admitted only to regular courses or to work as nearly regular as their preparation allows, unless on special action of the faculty. Students over twenty-one will be admitted to such work, not less than twelve credits, (allowance being made for music) as the schedule permits, and their class officers approve.

Change of Registration.—A student desiring to change his studies will present his request to his class officer, who, after consulting all teachers interested, will take such action as he may deem best. Change in registration will be made after four weeks for extraordinary reasons only. Requests for changes in registration will not be considered during the last eight weeks of a semester.

A change of course of study is allowed by a vote of the faculty only.

Attendance.—A student tardy or absent from any class will present the reason for the tardiness or absence at the first appearance at such class after the tardiness or absence occurred. The teacher will be the judge of the sufficiency of the excuse. A student absent from class the third consecutive time will be reported to the class officer and the president. A student who has been three times tardy or absent and is unable to present a satisfactory excuse is immediately suspended and will be reinstated only by a vote of the faculty.

Leave of Absence.—When it is necessary for a student to be absent from the city for a day or more application must be made to the president for leave of absence. A leave of absence is a justification for absence from class but does not give relief from the work omitted.

Conditions and Failures.—An average standing of less than fifty per cent. for any semester's work shall be termed a "failure," and the work must be made up by repeating the subject the following year.. An average standing for the semester of more than fifty per cent. and less than passing grade shall be termed a "condition." A condition must be removed by a special examination before the beginning of the semester in which the subject is next taught. If not removed within this limit the condition shall become a failure, to be made up by immediately repeating the subject. Examinations for removing conditions shall be held on the Monday and Tuesday preceding the beginning of the college year, and on the last Friday and Saturday of each semester, and at no other time. Laboratory work falling below the grade in quality or quantity shall be marked deficient and shall be made up within the same time limit as conditions.

Students whose work is unsatisfactory will be reported to the class officer and the president and information will be sent to the parents or guardians.

Government.—Students are expected to conduct themselves as ladies and gentlemen; those who fail to comply with this demand will be requested to leave the institution.

Work for Exhibition.—It is required that students who have done work suitable for exhibition purposes shall place such work at the disposal of the institution for a period of two years.

Assembly.—Students are requested to attend the weekly assembly, at which lectures are delivered by members of the faculty and others.

Student Organizations.—All public performances given by students or student organizations, using the name of the college, will be under the supervision of the committee on student organizations.

Military Drill.—All male students, except aliens, those physically disqualified, members of the junior and senior classes, and student assistants, are required to take military drill, satisfactory work being requisite for graduation.

Advanced Degrees.—On the completion of one year of post-graduate work or three years of professional work, and the presentation of an acceptable thesis, the college will confer upon its holders of bachelors' degrees in their respective courses, the degrees of Master of Science, Master of Scientific Agriculture, Mechanical Engineer, Electrical Engineer and Civil Engineer.

Honorable Dismissal.—Students intending to sever their connection with the institution either indefinitely or permanently should report as soon as possible to the president either in person or in writing, giving proper explanation, and should apply for an honorable dismissal. Students leaving the institution without such honorable dismissal (except at the end of the college year) will not be re-admitted to the college at any later time, nor will any reports or grades in credit for work done here be sent out until a satisfactory explanation is made.

PRIZES.

An annual prize of twenty dollars was founded several years ago by Col. O. P. Chisholm, of Bozeman, a member of the state board of education, for the winner in the local oratorical contest open to all students.

For the year 1905-1906 a number of prizes are offered. Hon. F. K. Armstrong, of Bozeman, gives a prize of ten dollars for the winners of a special declamatory contest, open to all regular students of the preparatory department.

Seniors in electrical engineering are eligible to compete for the Edison medal. This medal was established at the 25th anniversary of the invention of the incandescent lamp, and is awarded annually by the American Institute of Electrical Engineers, to the student presenting the best thesis in electrical engineering. Competition is open to two students from each college of recognized standing in the United States and Canada.

During the past year two prizes have been open to the students in animal industry. The Zenoleum company gave a medal to the student of the college who showed himself most proficient in judging stock. A valuable cup offered by the State Fair Association for the best work by any young man in the state in stock judging was won by a student of the college, though competed for by many outsiders. The Association will offer a prize of equal or greater value this year for the same work.

ACCREDITED HIGH SCHOOLS.

Following is a list of the accredited high schools of the state, divided into groups according to their organization. City High Schools: Anaconda, Billings, Butte, Forsythe, Fort Benton, Glendive, Great Falls, Hamilton, Helena, Missoula, and Virginia City. County High Schools:—

Beaverhead, Dillon; Broadwater, Townsend; Carbon, Red Lodge; Custer, Miles City; Fergus, Lewistown; Flathead, Kalispell; Gallatin, Bozeman; Granite, Phillipsburg; Jefferson, Boulder; Park, Livingston; Powell, Deer Lodge; Sweetgrass, Big Timber; Teton, Choteau.

COLLEGE ORGANIZATIONS.

The Young Men's Christian Association—The association is the only organization among the young men of the college for Christian fellowship and aggressive Christian work especially by and for students. It is undenominational in character and is fitted to reach most effectively the young men of the college.

Its lines of activity are numerous . It welcomes new students and assists them in getting started in college life; it aids in securing work for those who desire to work their way. It promotes good fellowship by conducting social gatherings among the students, and organizes concerts and lecture courses. To promote the religious life of the college it conducts mission study courses, a Bible study course and prayer meetings; and secures addresses by religious workers.

The Young Women's Christian Association.—The object of this association is the all-round development of Christian womanhood. It cooperates with the Y. M. C. A. and carries on systematic Bible study and conducts devotional meetings.

Literary Societies.—The college has now three literary societies, the Arena, for the college young men, and the Hamiltonia for the college young ladies. The preparatory students during the past year have organized a literary society, the Philomathian, especially for that department. All these are doing good work.

Oratorical Association.—This organization has charge of all oratorical and debating contests with other institutions. These contests have been maintained for a number of years.

Engineers' Society—This society admits as active members all students enrolled in the regular college courses in engineering, and as associate members students taking any engineering studies.

College Choristers.—The Glee Club, consisting of twenty voices, with F. A. Oliver as conductor, has entered upon its second year and gives much promise of becoming an effective college chorus.

The Exponent.—A monthly publication in magazine form, under the above name, is maintained throughout the college year entirely under student supervision and control. The editor-in-chief thereof is elected annually by the student body at the close of each year; he is empowered to appoint the staff from those he judges to be best fitted for the work.

The Athletic Association.—This association, organized in 1905, has general control of the athletic interests of the college, subject to the supervision of the faculty. The interest of the students, thus far, has been given to football, baseball, basketball, track athletics and lawn tennis.

DEGREE CONFERRED.

Commencement, June, 1905.

FRANK W. HAM, M. S., Bozeman.

LIST OF STUDENTS, 1905-1906.

This list includes all those entered upon the college registration list from Dec. 1, 1904, to Dec. 1, 1905.

POST GRADUATE. 1.

Cockrill, Irvin	Civil Eng.	Bozeman

SENIORS. 7.

Benton, Ralph	Zoology	Washington, D. C.
Bole, William Symington	Zoology,	Great Falls.
Chaffee, Catherine Sarah	Zoology	Bozeman.
Flager, Howard A.	Electrical Eng.	Red Lodge.
Kirk, Mary	History	Bozeman.
Penwell, Clyde C	Mathematics	Bozeman.
Potter, Ermine L.	History	Bozeman.

JUNIORS. 18.

Baker, Harold E.	Elect. Eng.	Bozeman.
Boyles Ralph G.	Elect. Eng.	Bozeman.
Brenneman, Anna T.	Mathematics	Bozeman.
Bull, Frieda Mildred	Mathematics	Bozeman.
Burke, Edmund	Chemistry	Bozeman.
Butter, Donald	Elect. Eng.	Culbertson.
DeMuth, Maud Susannah	Mathematics	Peru, Ind.
Flager, Harold J.	Elect. Eng	Red Lodge.
Griffith, Warren James	Elect. Eng.	Gebo.
Hartman, Lois	Dom. Science	Bozeman.
Lorentz, Floyd Sheldon	Elect. Eng	Toston.
Mountjoy, Agnes	Mathematics	Twin Bridges.
Osborn, Belle	Dom. Science	Bozeman.
Pease, Jay Levi	Civil Eng.	Bozeman.
Penwell, Clyde Winfred	Elect. Eng	Bozeman.
Quaw, Thomas B.	Zoology	Bozeman.
Thorpe, Elizabeth	History	Bozeman
Thorpe, Mabel Adelaide	Mathematics	Bozeman.

SOPHOMORES. 24.

Bromley, Arthur Clarence	Mathematics	Bozeman
Carmichael, Flora W.	History	Bozeman.
Cook, Hiram Douglas	Civil Eng.	Como.
Driscoll, Wm. J.	Civil Eng.	Lawrence, Mass.
Ervin, A. Fred	Mech. Eng.	Bozeman.
Fisher, Charles McCabe	Elect. Eng.	Bozeman.
Gottschalck, Carl	Chemistry	Bozeman.
Gregory, Harry W.	Agriculture	Gebo.
Hartman, William	Civil Eng.	Bozeman.
Hutton, Ethel Lois	History	Jeffers.
King, Ruby Ellen	Dom. Science	Bozeman.
Livingston, Walter T.	Elect. Eng.	Bozeman.
Morgan, Phoebe	Dom. Science	Belgrade.
Morris, Agnes	Mod. Language	Bozeman.

Mountjoy. Irvin	Elect. Eng.	Twin Bridges.
Osborn, Dean Hill	Zoology	Bozeman.
Osborn, Earl B.	Agriculture	Bozeman.
Peterson, James Arthur	English	Absarokee.
Phillips, Ira	Mathematics	Utica.
Richards, Howell	Civil Eng.	Livingston.
Robinson, Wilbur	Chemistry	Bozeman.
Tracy, Edna	Chemistry	Bozeman.
Widener, Carl	Civil Eng.	Bozeman.
Yergey. Stanley	Civil Eng.	Bozeman.

FRESHMEN. 40.

Alward, Mamie	General Science	Bozeman.
Bull, Edna	General Science	Bozeman.
Carmichael, Effie	General Science	Bozeman.
Clark, Ida Grace	General Science	Belgrade.
Cooke, Amy Mendenhall	General Science	Bozeman.
Coppedge, Roy	Elect. Eng.	Fishtail.
Devore, Orin	Agriculture	Bozeman.
Gillett, Howard	General Science	Bozeman.
Hansen, Gilbert	Elect. Eng.	Bozeman.
Hartman, Flora	General Science	Bozeman.
Hawthorne, David	Elect. Eng.	Red Lodge.
Henderson, C. Lisle	Elect. Eng	Livingston.
Hodson, Rodney	Civil Eng.	Bozeman.
Holgate, Ralph	General Science	Manhattan.
Jones, Gladys	General Science	Bozeman.
Kelly, Helen	General Science	Bozeman.
King, Bertha	General Science	Bozeman.
King, Charles	Elect. Eng.	Fort Benton.
King ,Gladys	General Science	Bozeman.
Kirscher, Guy	Elect. Eng.	Townsend.
McCullough, Grace	General Science	Gebo.
Milner, Thomas	Civil Eng.	Milner.
Morris, Elwood	Agriculture	Virginia City.
Morrison, Bertha	General Science	Bozeman.
Mountjoy, John	Agriculture	Twin Bridges.
Mountjoy, Lucile	General Science	Twin Bridges.
Moxley, Wellington	Elect. Eng.	Bozeman.
Noble, Erma	General Science	Bozeman.
Robinson, James Frederick	Agriculture	Bozeman.
Smith, Harry D.	Civil Eng.	Amboy, Ind.
Solberg, Inga	General Science	Howie.
Spain, W. Whitfield	Agriculture	Bozeman.
Stewart, Harry A.	Elect. Eng.	Helena.
Stuart, Gordon	General Science	Hamilton.
Titus, Leo. G.	Civil Eng.	Helena.
Vreeland, Edna	General Science	Bozeman.
Widener, Ethel	General Science	Bozeman.
Wilson, Elva	General Science	Bozeman.
Yeaton, Walter	General Science	Livingston.
Zenor, H. N.	General Science,	Deer Lodge.

The following students, though they have not completed the work required for admission to college, have been admitted conditionally to collegiate classes: 16.

Bird, F. W.	Civil Eng.	Great Falls.
Callahan, Charles	General Science	Bozeman.
Giles, George	Elect. Eng.	Bozeman.
Green, W. J.	Civil Eng.	Fort Benton.
Homan, Fred C.	Mech. Eng.	Bozeman.
James, John Sexton	Elect. Eng.	Cascade.
Kimpton, Addie	General Science	Radersburg.
Kremer, John	General Science	Bozeman.
Kremer, Wm. J.	Civil Eng.	Bozeman.
Newcomb, Otis	Chemistry	Corning, Iowa.
Randall, H. W.	Civil Eng.	Great Falls.
Scott, J. R.	Agriculture,	Red Rock.
Throm, H. N.	Civil Eng.	Great Falls.
Williss, James E.	Mech. Eng.	Sheridan.
Woods, Vincent K.	Civil Eng.	Stevensville.
Wylie, Clinton	Agriculture,	Bozeman.

ART COURSE.

Bulen, Bessie	Bozeman.	Jackson, Edith,	Ferguson.
Connard, Clara	Bozeman	Piedalue, Alice	Bozeman.—4.

THIRD YEAR.

Allard, Louis	Laurel	Hogan, George R.	Musselshell
Allen, Edgar W.	Red Lodge	Lewis, Max	Dewey
Bechtel, Leslie A.	Butte	Marshall, Bertha	Everett, Wash
Bell, James C.	Gilt Edge	Moore, Perry J	Two Dot
Draper, Charles H.	Red Lodge	Redfield, Emma	Manhattan
Flaherty, James	Cold Springs	Rich, Florence	Hunter's Hot Sp'gs
Froebe, Frank	Chatsworth, Ill	Winegar, Clyde L.	Bozeman
Griffith, Leslie	Pawnee City, Neb	Total	15.

SECOND YEAR.

Baker, Mary	Josephine	Higgins, James	Kendall
Bessette, Wm.	Fulton	Hutton, Earl	Jeffers
Coombs, Ethelbert	Laurel	Hutton, Hiram	Jeffers
Cook, Geo. H.	Como	Krohm, Thorwald	Livingston
Creel, Cecil	Crow Agency	Roberson, Thos.	Sixteen
Daggett, Thomas	Phillipsburg	Smith, Maud	Hyde
Draper, Edwin	Red Lodge	Sloan, Charles	Bozeman
Draper, Irvin	Red Lodge	Thompson, Wm.	Barry, Ill
Franks, Ethel	Bozeman	Total	17.

FIRST YEAR.

Brownlow, Wm.	Jardine	Landon, Clifford	Manhattan
Baker, Lulu	Bozeman	Lewis, Glenn	Dewey
Berg, Bernard	Melville	McNally, Harry	Helmville
Clark, Olive	Hunter's Hot Springs	Ostrom, Edna	Augusta
Crail, Eugene	Salesville	Shellenbarger, Margaret	Norris
Fly, Earl	Laurel	Smith, Phillip	Boulder
Foster, Warren	Willow Creek	Temple, Leslie	Radersburg
Guest, Robert	Jardine	Woolsey, Mary	McLeod
		Total	16.

IRREGULAR.

Brittan, Art	Bozeman
Christman, Eugene	Bozeman
Cruse, Jacob M.	Bozeman
Daggett, Otis	Phillipsburg
Davidson, Mary	Bozeman
Duncan, Zoe	Bozeman
Ehrig, Fred	Silver Star
Hammond, Bert	Forsyth
Koch, Lucie	Bozeman
Koch, Martha	Bozeman
Maynard, Frances	Jeffers
Peterson, Ismus	Odense, Den.
Sanford, Elizabeth	Great Falls
Yurgensen, Gerda	Copenhagen, Den.
Total	14.

ONE YEAR COURSE IN DOMESTIC SCIENCE.

Arnold, Alberta	Bozeman
Arnold, Alice	Bozeman
Bradley, Barbara	Bozeman
Callaghan, Marguerite	Bozeman
Cook, Josephine	Lexington, Ohio
Davitt, Clara	Bozeman
Dodgson, Millie	Dewey
Evans, Mrs. Earl	Bozeman
Fly, Alma	Laurel
Hansen, May	Dillon
Hughes, Minnie	Bozeman
Kountz, Mayme	Bozeman
Krueger, Anna	Bozeman
La Rue, Edna	Bozeman
Lower, Ellen	Sadie
Martin, Julia	Bozeman
Michener, Myrtle	Bozeman
Nelson, Mrs. Adolph	Bozeman
Nichelson, Joan	Moore
Owen, Hallie,	Rice, Wash
Sayre, Mabel	Martinsdale
Schmidt, Zula	Salesville
Tidball, Haddie	Bozeman
Timmons, Ina Belle	Havre
Winslow, Miss	Clancy
Walker, Mrs. Clyde	Bozeman
Work, Vida	Bozeman
Total	27.

WINTER COURSE IN AGRICULTURE.

SECOND YEAR.

Bessette, Arthur	Fulton
Barnes, Wm. V.	Helena
Brittan, Edward	Bozeman
Hansen, Charles	Dillon
McElwain, Lee	Helmville
Nash, Harold	Big Timber
Udall, G. O.	Big Timber
Woolman, Ossie	Red Lodge
Total	8.

FIRST YEAR.

Austin, Wm. H.	Bozeman
Behring, Oliver	Bozeman
Dawson, Harry	Bozeman
Davidson, Edward	Manhattan
Falen, Charles F.	Rock Creek
Featherly, Geo. R.	Dillon
Gilbert, Philip H.	Clyde Park
Gray, Charles	Bozeman
Gray, Wright	Bozeman
Kirk, John	Bozeman
Lemmon, Chas. Elmer	Rockvale
McNally, Harry	Helmville
Nelson, George	Bozeman
Neal, George	Wisdom
Rife, Andrew J.	Dillon
Robinson, Wm. H.	Bozeman
Selway, Roy R.	Dillon
Sandquist, Charles,	Belgrade
Sheridan, Phil	Bozeman
Trzcinski, John J.	Woolsey
Willis, George E.	Sheridan
Total	21.

WINTER COURSE IN ENGINEERING.

SECOND YEAR.

Crail, Eugene	Salesville
Eikenbarry, C. R.	Gebo
Remington, Lenardo,	Willow Creek
Robinson, Edw. F,	Springfield, Mo.
Vincent, Le Roy	Meadow Creek
Total	5.

FIRST YEAR.

Blewett, Elmer E.	Fromberg
Crawford, D. E.	Shawmut
Daniels, William C.	Canton
Ehrig, Fred E.	Silver Star
Green, Jesse R.	Manhattan
Haynes, George	Clancy
Kemmer, Bert	Cokedale
Leverich, Raymond	Joliet
Le Fevre, W. T.	Kalispell
Morrison, Charles	Meadow Creek
Norman, Chauncey F.	Springhill
Phillips, George	Utica
Spain, Rhodes	Bozeman
Solberg, Sam D.	Howie
Taylor, Frank	Great Falls
Tuggle, John S.	Gebo
Timmons, George	Havre
Williams, Wilber	Garneill
Williams, Wilfred	Garneill
Total	19.

BOOKKEEPING.

Allen, Clarence	Pine Creek
Austin, Will H.	Cascade
Barclay, Foster	Norris
Bell, Chas. H.	Willow Creek
Bell, Robert B.	Willow Creek
Bell, Christine H.	Belgrade
Bye, Johnnie	Capitol
Calfee, Nettie	Bozeman
Clark, Ben	Springdale
Cleveland, Roy	Bozeman
Crittenden, Florence	Bozeman
Cox, Clifford	Bozeman
Davis, Cornelius	Bozeman
Davis, Mabel	Belgrade
Dart, Fred Walter	Dillon
Elgin, Anna	Miles City
Eikenbarry, C.	Gebo
Fridley, Charles	Bozeman
Finlay, Ruth	Bozeman
Giles, Carl	Thondike, Me
Halberg, Togge D.	Leighton, Ala
Hall, Arthur	Gardiner
Hansen, Chas. L.	Dillon
Hansen, Gilbert Edw.	Bozeman
Hancock, Charles	Bozeman
Haskins, Melissa Laura	Bozeman
Hermsmuyer, Harry Fred	Sheridan
Hapner, Bert	Bozeman
Jeffers, Bertha	Jeffers
Kountz, Frank	Bozeman
Kelley, Edward	Gardiner
Lemmon, Chas. E.	Silesia
McDaniel, Victoria	Bozeman
Mannix, John	Canton
Martin, Fred C.	Humansville, Mo
McCauley, Fred C.	Bozeman
Malmburg, Edw. F.	Chesnut
Mitchell, Lon Clyde	Park City
Nichols, Grace	Bozeman
Orton, Pearl	Bozeman
Phillips, John Holmes	Lewistown
Perry, Clifford	Bozeman
Peters, Woodie Reeves	Livingston
Rich, Irvin	Dillon
Remington, L.	Meadow Creek
Robinson, E. F.	Central Park
Ralston, Harry M.	Choteau
Story, Ralph	Park City
Swartz, Myrtle,	Bozeman
Selway, R. J.	Dillon
Selway, R. R.	Dillon
Sprague, Kate May	Bozeman
Simpson, Ralph L.	Joliet
Stubblefield, Albert M.	Forsyth
Tronrud, Amelia	Melville
Tronrud, Caroline	Melville
Timmons, George	Graham, Tex
Tillery, Hetty	Bozeman
Vincent, L.	Meadow Creek
Wallace, Maud May	Castle
Wohlgenant, Bertha	Miles City
Wright, Clark	Bozeman
Warhover, John L.	Chesnut
Total	63.

STENOGRAPHY.

Aakjer, Anna	Belgrade
Freeman, Beatrice	Bozeman
Hammond, Mayme L.	Forsyth
Hollier, Effie	Bozeman
Hansen, Annie	Bozeman
Johnson, Julie	Stevensville
Kane, Mildred	Bozeman
Kleven, Minnie	Bozeman
Kremer, Lucile	Mt. Carroll, Ill
Lundwall, Nelson B.	Bozeman
Long, Louie	Bozeman
Moore, Ernest	Choteau
Murray, Bertha	Townsend
Nichols, Grace	Bozeman
Perkins, Mrs. A. A.	Bozeman
Sanderson, John	Havre
Wohlgenant, Bertha	Miles City
Total	17.

MUSIC DEPARTMENT.

PIANO.

Alward, Coda ....Bozeman
Armstrong, Lena ....Bozeman
Baker, Florence ....Bozeman
Brown, Edith ....Bozeman
Carney, Florence ....Springdale
Donaldson, Jeanette ......Bozeman
Durham, Ella ....Bozeman
Elliott, Mrs. W. J.......Bozeman
Evans, Mrs. D. E.........Bozeman
Featherston, Beth ....Bozeman
Featherston, Ellis ....Bozeman
Fisher, Helen ....Bozeman
Fisher, Mrs. O. D.........Bozeman
Freeman, Beatrice ....Bozeman
Freeman, Lorraine........Bozeman
Griffin, Grace ....Bozeman
Griffith, Gilbert ....Gebo
Hansen, May ....Dillon
Hartman, Flora ....Bozeman
Hoy, Kate ....Bozeman
Jeffers, Bertha ....Jeffers
Jones, Gladys ....Bozeman
Jones, Hayden ....Bozeman
King, Bertha ....Bozeman
King, Gladys ....Bozeman
Kirschner, Hortense ......Bozeman
Kountz, Mayme ....Bozeman
Lansing, Grace ....Bozeman
Maynard, Frances ....Bozeman
Miller, Bertha ....Logan
Orton, Viola..............Bozeman
Piedalue, Alice ....Bozeman
Quaw, Marjorie ....Bozeman
Robertson, Mary ....Bozeman
Rostad, Regina ....Big Timber
Schumacher, Hettie ....Bozeman
Small, Nora ....Manhattan
Stewart, Mildred ....Bozeman
Stubblefield, Minnie ......Bozeman
Thorpe, Bess ....Bozeman
Thorpe, Florence ....Bozeman
Thorpe, Mabel............Bozeman
Walker, Cora ....Bozeman
Widener, Ethel ....Bozeman
Wilson, Elva ....Bozeman
Work, Vida ....Bozeman
Total 44

HARMONY.

Alward, Coda ....Bozeman
Brown, Edith ....Bozeman
Evans, Mrs. D. E..........Bozeman
Featherston, Ellis ....Bozeman
Freeman, Lorraine ....Bozeman
Griffin, Grace ....Bozeman
Hartman, Flora ....Bozeman
Jeffers, Bertha ....Jeffers
Maynard, Frances ....Bozeman
Orton, Viola ....Bozeman
Piedalue, Alice ....Bozeman
Widener, Ethel ....Bozeman
Work, Vida ....Bozeman
Total ....13.

VOCAL.

Adams, Walter ....Bozeman
Damarell, Cora ....Bozeman
Featherston, Ellis ....Bozeman
Freeman, Hazel ....Bozeman
Hartman, Flora ....Bozeman
Hartman, Will ....Bozeman
Hansen, May ....Dillon
Kopp, Mrs. John ....Bozeman
Lovelace, Amy ....Bozeman
More, Mrs. E. V...........Bozeman
Maynard, Frances ....Jeffers
O'Connell, Minnie ....Bozeman
O'Dell, Luella ....Manhattan
Richards, Howell,....... Livingston
Sanford, Elizabeth.....Great Falls
Smith, Mrs. D. D.........Bozeman
Spieth, Mrs. Carl.........Bozeman
Zenor, H. N............Deer Lodge
Total ....18.

VIOLIN.

Bigelow, Alton . . ..Bozeman
Bole, William ....Great Falls
Featherston, Beth ....Bozeman
Featherston, Josephine E, Bozeman
Fisher, Charles ....Bozeman
Hammond, Bert ....Forsyth
Perkins, Lillian ....Bozeman
Thompson, Jesse ....Bozeman
Work, Lester ....Bozeman
Total .... 9.

SUMMARY

College Courses	110.
Preparatory Department	62.
One Year Domestic Science Course	27.
Winter Course in Agriculture	29.
Winter Course in Engineering	24.
Business Courses	80.
Music Courses	84
Total	416
Counted Twice	40.
Net Total	376

COLLEGE PUBLICATIONS.

The college issues the following publications any or all of which will be sent to any address upon application as soon as issued. Address J. M. Hamilton, President, Bozeman, Montana.

General Information.—Including a full account of the organization of the college, a description of its buildings and equipment, a full statement of fees, and a list of students.

General Science.—The work in general science arranged according to the group system leads to the degree of B. S. The student selects one of the groups of studies arranged about each of the following subjects: Biology, Chemistry, Domestic Science, Mathematics and Physics, History and Literature.

Agriculture.—A full outline of the college course in agriculture, leading to the degree of Bachelor of Scientific Agriculture, with an account of the studies pursued.

Engineering.—An outline of the courses in mechanical, electrical and civil engineering, leading respectively to the degrees of Bachelor of Mechanical, Electrical and Civil Engineering, with an account of the subjects studied in each course.

Preparatory Department.—Outlines of the preparatory courses, Academic, Agriculture, Domestic Economy and Manual Training, any one of which prepares for any of the college courses.

Business.—An outline of work in bookkeeping, business practice, stenography and typewriting with related work in English, penmanship, commercial law and other branches.

Art.—An outline of the work in art, providing a course of four years, more or less, with a description of methods and equipment.

Domestic Science.—An account of all the work offered in domestic science, both in one year, preparatory, and four year courses.

Music.—A full account of the work offered in the piano department, the violin department and in the vocal department ,with a statement of the fees. The tuition in hese deparments is charged separately.

Winter Courses.—An account of winter courses in agriculture and engineering, which will begin November 13 and end March 29. These courses have no requirements for entrance, the fees are smaller than for the other courses and the work is intended to be immediately practical. This bulletin will be issued in September 1906.

Bulletin of THE MONTANA STATE COLLEGE *of* AGRICULTURE *and* MECHANIC ARTS.

FOUNDED EIGHTEEN HUNDRED NINETY-THREE

Volume 3. *Number 4*

The Courses in General Science.

Published Monthly by the College
During the College Year. . . .
JANUARY 1, 1906

Entered April 14, 1904, at Bozeman. Montana, as Second Class Matter Under Act of Congress of July 16, 1894.

FACULTY IN GENERAL SCIENCE.

JAMES M. HAMILTON, M. S., (Union Christian College), President.
Professor of Philosophy and Economics.

MRS. F. E. MARSHALL.
Professor of Art.

WILLIAM F. BREWER, A. M., (Harvard University),
Professor of Latin and English.

AARON H. CURRIER, A. M., (Oberlin College),
Professor of French and German.

MISS LILLA A. HARKINS, M. S., (South Dakota Agri. College.),
Professor of Domestic Science.

ROBERT A. COOLEY, B. S., (Massaschusetts Agri. Col.),
Professor of Zoology and Entomology.

WILLIAM D. TALLMAN, B. S., (University of Wisconsin),
Professor of Mathematics.

WILLIAM M. COBLEIGH, A. M., (Columbia University),
Professor of Physics.

VICTOR K. CHESNUT, B. S., (University of California),
Professor of Chemistry and Geology.

MISS HELEN R. BREWER, A. B., (Iowa College),
Instructor in Latin and History.

MRS. MABEL KINNEY HALL, Ph. B., (Oberlin College),
Instructor in Public Speaking.

EDMUND BURKE,
Instructor in Chemistry.

MISS FLORENCE A. BALLINGER,
Instructor in Sewing.

WYATT W. JONES, S. B., (Harvard University),
Instructor in Botany and Zoology.

GENERAL SCIENCE GROUPS.

Requirements For the Degree of Bachelor of Science.

The college does not prescribe in detail a full course for the bachelor's degree, but leaves to the individual student not only the choice of the general line of his work, but a considerable freedom in the selection of his work in detail. But in order to afford the student guidance in the choice of his elective work, a group system has been established, and at the end of the freshman year the student elects to follow some one of these groups.

For convenience in estimating the requirements for a degree the following rules are laid down: One hour a week for a semester of recitation or lecture work, or two hours a week for a semester of laboratory or library work or drawing, shall count as one credit.

Candidates for the bachelor's degree must complete satisfactorily not less than 130 credits, including the prescribed work in military drill, or domestic science; and including also a thesis, the value of which in credits shall be determined by the instructor concerned. No regular student may take in any one semester work amounting to more than nineteen credits or less than twelve.

Students who are relieved for any reason of the requirements in military drill or domestic science, shall present four additional credits in some other subject; but the president may, at his discretion, excuse from such requirements any student in the employ of the institution.

Students who complete the work prescribed on the following page for all candidates for a degree, together with the work laid down in any one of the groups, will be recommended for the degree of Bachelor of Science.

All students one-half of whose work shall have received the grade of A or B will be recommended for the degree "cum laude." All students, one-half of whose work shall have received the grade of A, will be recommended for the degree "magna cum laude."

Several subjects taught in departments not represented in these groups are open to election by general science students on consent of their advisers. Among these may be mentioned Agriculture (described in the agricultural course), Shop Work (described in the engineering course), Bookkeeping and Stenography (described in the statement of the business department), Surveying (described in the civil engineering course), Music, (described in the bulletin of the musical department). The credits to be allowed for these subjects will be decided upon agreement of the instructors concerned.

PRESCRIBED FOR ALL CANDIDATES.

Among the 130 credits required for the degree of bachelor of science, the preliminary list subjoined shows the work prescribed for all candidates for the degree.

Preliminary List.*

Freshman Year.—Mathematics (1, 2 & 3), 9; Chemistry (1 and 2) 8; English, (1), 4; Public Speaking, 2; Foreign Language, *** 8; Art, (1, 2, 3, 4 or 5), 2; Military Drill, (for men), 2; Domestic Science, (for women), 2.

Sophomore Year.—Foreign Language, 6; English, (10)**** or History (1 or 2), 4; Physics (1 and 2), 10; or**Biology, (1a and 9), 10; Military Drill (for men), 2; Domestic Science (for women)), 2.

Junior and Senior Years.—English (10) **** or History (1 or 2), 4; Physics (1a), 6 or **Biology, (1b and 6), 6; Ethics, 3; Psychology, 3; Economics, 4.

For the remainder of his work the student must choose one of the five groups following, and be guided by its prescriptions and limitations in the direction of his work. Some freedom of choice in a part of the work is ordinarily allowed, but the student will be under the guidance of the instructor presiding over his group. It is to be noted that no subject may at any time be chosen that conflicts with prescribed work.

The folowing groups are offered: Biology, Chemistry, Domestic Science, History and Literature, Mathematics and Physics.

BIOLOGY.

Beside affording an opportunity for acquiring a liberal training in science, language and philosophy, the biology group offers special work in botany and zoology.

Sophomore Year.—Zoology, (1a), 5; Botany, (9), 5; elective 2 to 16

Junior Year.—Botany (10), 4; Zoology, (2), 5; elective, 2 to 16.

Senior year.—Zoology (3), 4; Zoology (4), 5; elective 12 to 16.

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*In the following outlines, figures in parenthesis are numbers of the sub-courses. Other Arabic numerals denote the number of credits allowed for each sub-course. The Roman numerals I and II are used to designate the two semesters of the year. Hence, Botany (9), 5, II, means Botany, sub-course 9, a five-credit course, given in the second semester. Chemistry (1, 2), 8, I and II, means Chemistry, sub-courses 1 and 2, counting together 8 credits, and running throughout the year. An account of the sub-courses may be found following the groups. The subjects are there arranged in alphabetical order,, except the subjects taught by the president.

**If Physics is taken in the sophomore year, Botany and Zoology must be taken in the junior year, and vice versa.

***Latin, French or German.

****Both these subjects are required of all candidates for a degree. At least one must be taken in the sophomore year; the other may be taken in the junior or senior year.

CHEMISTRY

The purpose of the course in chemistry is to make educated chemists, men who are not only qualified to make correct analyses, make chemicals, and to patent and install manufacturing processes, but who have also had, with their technical training, a good, liberal education. The possibilities of the successful application of chemical knowledge to the solution of the problems of daily life on the farm, in the smelter, the dye works, the sugar factory, the gas works and in nearly all manufactures and the arts are well recognized in the industrial world.

A reading knowledge of French and German is required for graduation from this group.

Sophomore Year.—Quantitative Analysis, (6), 5; Inorganic Preparations, (8), 4, or Advanced Inorganic Chemistry, (3), 6; Organic Chemistry, (10 and 11), 6. (In this group, the sophomore science requirement from the preliminary list will be biology.)

Junior Year.—Physical Chemistry (4 and 5), 5; Advanced Inorganic Chemistry, (3), 6, or Inorganic Preparations, (8), 4; or Geology, (1), 5; Crystallography, 1; Mineralogy, 2; Quantitative Analysis (7 and 12), 8: Seminar, 2. (In this group the junior science requirement from the preliminary list will be physics.)

Senior Year—Quantitative Analysis (13), 3; Toxicology (4), 2;Geology, 5, or Inorganic Preparations (8), 4; Seminar, 2: Thesis, 9.

DOMESTIC SCIENCE.

It is the purpose of the Domestic Science group to give women a liberal education with a scientific basis. It is also designed to provide an opportunity for the correlation of chemistry and biology with household work.

Normal training, both in sewing and cooking ,is given to those students who are preparing to become domestic science teachers. The work of the department aims to be scientific, artistic and practical

Sophomore Year—Domestic Science (2 and 3), 4; Sewing (8) II, 2; Art (1, 2, 3, 4, or 5), I, 2; elective, 4.

Junior Year—Domestic Science (4 and 5), 4; Sewing (9), 2; Chemistry (15), 8; elective, 7.

Senior Year—Domestic Science (6). 4; English (11) or foreign language 4. Six credits in allied subjects to be assigned on consultation with the instructor. Sewing, 4. Elective and Thesis, 8.

HISTORY AND LITERATURE.

The work outlined below is planned for those students who, though wishing a broad foundation in science, do not desire to specialize in any one science. It includes a variety of work in addition to that prescribed in the Preliminary List, and especially makes considerable additions to the requirements in foreign languages. While these groups do not in any way anticipate the work of a graduate school, the student may so choose his electives as to be adequately prepared at the end of his college course for graduate work in any one of these three subjects.

Sophomore Year—Foreign Languages, 6 or 8**. Elective, 2 to 4. (The History and English, which may be taken in different years, as given in the Preliminary List, are both taken in the sophomore year in this group.)

Junior Year—Foreign Language, 6; English (11), 4, or, History (2), 4; United States Constitution, 2. Elective, 12 to 14.

Senior Year—Sociology, 3. Elective and Thesis, 17 to 20.

MATHEMATICS AND PHYSICS.

This group is so arranged as to afford a broad foundation in science, language and philosophy ,with a somewhat more special training in Mathematics and Physics. It is purposed to prepare for teaching and at the same time lay the foundation for the work of the graduate school. Students expecting later to take engineering may so arrange their work in this group that they may complete their engineering course in two years after graduation.

A reading knowledge of German and French is required for graduation from this group, and it is desirable that it should be acquired during the first two years of the course, as these languages will be very useful for the work of later years.

Sophomore Year—Mathematics (3 and 4), 10; Physics (1 and 2)*, 10. Elective, 0 to 8.

Junior and Senior Years—Twenty credits must be chosen in Mathematics and Physics, with a minimum of four in either subject. Thesis, 6. Elective, 12 to 30.

THE SUBCOURSES.

PHILOSOPHY AND ECONOMICS.

PRESIDENT HAMILTON.

(1.) **Psychology**—This course presents a general view of modern psychology and is required of all general science students. It gives a practical exposition of the materials and methods of psychological investigation. The lectures are accompanied by class demonstrations. Attention is given to such topics as the growth of the central nervous system, the nature of consciousness, sensory and motory training, the higher intellectual faculties and the will. So far as possible the work is made practical and concrete. I, 3.

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*See Preliminary List.

**In addition to that already prescribed in the Preliminary List.

(2.) .**Ethics**—The work in ethics includes a study of the evolution of conduct, moral standards, the social and industrial life, the development and trend of ethical thought and an examination of utilitarianism. Required of general science students. II, 3.

(3.) **Economics**—This course consists of a study of such questions as land, capital, labor, money, coinage, banking, rent, interest, wages and taxation. The most important questions in economics of the present time are considered. Among these may be mentioned trusts, labor organizations, government ownership of public utilities, co-operation, recent currency legislation and the single tax. Required of general science students. I and II, 4.

(4.) **International Law**—Woolsey's text book is used, but is supplemented by lectures and library work. In addition to the study of the principles of international law, an examination is made of treaties and the findings of international congresses. A practical study is made of the important questions in which our own government is especially interested, such as the Monroe Doctrine, the Eastern question, international arbitration, etc. Elective, II, 3.

ART.

MRS. MARSHALL.

(1.) **Drawing From Nature**—Drawing and painting of plants and animals, intended especially for students in biology. It may be taken in either semester separately. I and II, 2-6.

(2.) **Architectural Drawing**—Studies in perspective and architectural forms, intended especially for students in engineerng and allied pursuits. It may be taken in either semester separately. I and II, 2-6.

(3.) **Normal Work**—This is a course in the training of the eye and hand and in the methods of teaching, intended especially for those who may be planning to teach art. Those who take this work will be allowed some opportunity for practice in teaching. I or II, 4-8.

(4.) **Applied Design**—Studies in color harmony, and historic ornament, leading up to practical designing for the various handicrafts,—embroidery, decoration, wood carving, joinery. I and II, 2-8.

(5.) **Clay Modeling or Wood Carving**—Study in light and shade and their application to designing in the handicrafts. I and II, 2-8.

BIOLOGY.

PROF. COOLEY.
MR. JONES.
MR........................

(1a) Invertebrate Zoology.—Devoted to a study of the invertebrate animals, including their morphology, development, habits, economic or popular interest and classification. The broad biological principles are brought out and emphasized. The class room work is based on Weysse's "Synoptic Text Book of Zoology." The laboratory exercises include a study of the morphology of types, reference reading and practical work in the classification of animals. Required of agriculture students and general science students except those in the mathematics and physics group. Class room exercises by Prof. Cooley. Laboratory work directed by Mr. Jones. I, 5.

(1b.) **Invertebrate Zoology.**—This course is the same as 1a except that less laboratory work is required. Required of mathematics and physics group students. I, 3. Prof. Cooley and Mr. Jones.

(2.) **Vertebrate Zoology.**—A continuation of (1a) taking up vertebrate (Chordate) forms. Required of agriculture and biology students. Elective for those who have taken (1a) or (1b). II, 5. Prof. Cooley.

(3.) **Animal Physiology and Histology**—The student is required to prepare for microscopical study a series of tissues taken from the bodies of freshly killed animals and these slides, together with a large series owned by the department, form the basis of an extended study of animal tissues. By a series of lectures, supplemented by reading courses, the student is taught the main facts of animal physiology. Required of agriculture and biology group students. Elective for general science and domestic science students. I, 4. Prof. Cooley.

(4.) **General Entomology**—Lectures on the morphology, metamorphoses and classification of insects and a study of the different orders. Collecting, naming, labelling and arranging in museum form species that are to be found in the vicinity of Bozeman. Required of biology group students. Elective for others who have taken 1a or 1b and 2. Two lecures and two laboratory exercises per week. II, 5. Prof. Cooley.

(5.) **Economic Entomology.**—A briefer account of the structure, metamorphoses and classification of insects followed by an extended study of the general principles underlying insect depredations together with an account of the more important insect pests of the garden, orchard and farm in Montana. Required of agriculture students. Three lectures and one laboratory exercise per week. II, 4. Prof. Cooley.

(6) **Economic Entomology.**—(For short course students). An eight weeks course of lectures, covering the insect world from an economic standpoint, including a discussion of the most common and injurious pests in Montana. First half of the winter term. Three lectures per week. Prof. Cooley.

(7) **Household Economic Entomology.**—Lectures on insect life injurious to food materials, clothing, carpets, draperies, etc. Required of college students in domestic science. Open to other lady students in the general science courses. Two lectures per week. I, 2. Prof. Cooley.

(8.) **Parasites of Domestic Animals.**—Lectures on the internal parasites of our domestic animals. Designed for students who will take up stock raising. Two lectures per week. Prof. Cooley.

(9) **General Botany.**—Anatomy, morphology and classification of the higher plants. Flower analysis and the making of a small herbarium. Required of all agricultural and general science students. Two lectures and three laboratory exercises per week. II, 5. Mr. Jones.

(10.) **Plant Physiology and Histology.**—Essentials of the histology and physiology of the higher plants. Required of agricultural students. I, 4. Mr. ....

(11.) **Diseases of Plants.**—After a brief survey of cryptogamic plants the more important fungus diseases of Montana plants are studied, together with means for their control. II, 4.

(12.) **Bacteriology.**—An elementary study of the life history of bacteria, their growth in nutrient media and methods of analysis and classification. Tne part they play in agriculture, medicine and our daily life is discussed. Required of agriculture and domestic science students. Elective to others so far as the limited space and equipment will allow. II, 4.

CHEMISTRY.

PROF. CHESNUT.
MR. BURKE.

(1) **General Inorganic Chemistry.**—Lectures with frequent recitations are given on the general principles of chemistry. The properties, preparation and applications of the elements and their principal compounds are studied.

The first semester will be given to the stuly of the non-metals and the second semester to the metals. Throughout the year lecture experiments will be performed, illustrating general principles and quantitative relationships. Fr. I—II, 4. Mr. Burke.

(2.) **Laboratory Experiments**—Accompanying course (1) is this laboratory course which comprises the preparation, physical and chemical properties, and the tests of the principal elements and inorganic compounds. Qualitative analysis and some quantitative experiments are also included.

The first semester will be taken up with the study of the elements, compounds, and quantitative experiments and the second semester with the study of qualitative analysis. Fr. I, II, 4. Mr. Burke.

(3.) **Advanced Inorganic Chemistry.**—In this lecture course the elements and their compounds are studied more in detail than in the first course, and special attention is given to the methods of preparation of the elements and of such of their compounds as are of commercial importance. The theory and practice of the use of acids, alkalies, salts, limes, mortars, cements, explosives, building stones and timber preservatives are also given. I and II, 6. Prof. Chesnut.

(4) **Physical Chemistry.**—A series of lectures and recitations on this important branch of chemistry in which the bearing of modern principles upon operations in the laboratory and on a larger scale in chemical manufacturing is brought out. A general survey of the subject with the special object of showing the practical application of recent chemical theories. I (with 5), 3. Prof. Chesnut.

(5) **Laboratory Work in Physical Chemistry.**—Practice in vapor density determinations and in the conductivity, freezing point, boiling point, and other methods applied to the determination of molecular weights. II, 2. Prof. Chesnut.

(6) **Quantitative Analysis, 1.**—The work begins with a study of the balance and of the weights and measures used in analytical work, and for the construction of tables of corrections to be used in future analytical work. Simple salts of unknown composition are first analyzed, and as the student gains in skill, he passes to substances of increasing complexity and of percentage composition unknown to him. His results must come within a small fraction of one per cent of the instructor's figures before they are accepted. II, 5. Mr. Burke.

(6a) **Iron and Steel Analysis.**—This work is intended to give the student a method of determining the properties of iron and steel and show how the presence of different elements affects the strength, magnetic properties, etc. The students are given preliminary work with known salts to develop the method of analysis after which they work upon iron and steel. Elective, I, 3. Mr. Burke.

(6b) **Fuel and Gas Analysis.**—A course in analyzing fuels with reference to their value as heat producers and of gases to determine the completeness of combustion. The students will first be given salts of known composition and after gaining some skill will take up the work with fuels and gases. Elective, I,3. Mr. Burke.

(7.) **Quantitative Analysis, 2** —An extension of the preceding course. I, 5. Mr. Burke.

(8) **Inorganic Chemical Preparations.**—The preparation of chemically pure laboratory reagents and other compounds including tests of the purity of the products. One lecture, one recitation, and laboratory work. I, 4. Prof. Chesnut and Mr. Burke.

(9) **Agricultural and Sanitary Chemistry.**—Lectures upon the origin, composition and physical properties of soils, the conservation of plant food and moisture, the composition of animal and vegetable tissues, the principles of nutrition, cooking, cleansing and of the disposal of sewage. I and II, 4. Prof. Chesnut.

(10) **Organic Chemistry.**—Lectures and recitations on the simpler compounds of carbon. Text book: Remsen's Introduction to the Study of the Compounds of Carbon. I, 3. Prof. Chesnut.

(11) **Laboratory: Organic Chemistry.**—A laboratory course to accompany course (10) and to familiarize the student with organic compounds and their manipulation. A series of chemically pure organic preparations will be made by each student. II, 3. Prof. Chesnut.

(12) **Quantitative Analysis**, 3—The work of a semester is devoted to a study of special methods and to a comparison of different methods with reference to accuracy of results and time required in obtaining them. Volumetric and electrolytic methods will be compared with ordinary gravimetric methods. II, 3. Mr. Burke.

(13) **Quantitative Analysis**, 4—Proximate organic analysis. Methods for analysis of organic compounds, such as grains, grasses, plants, milk, soils, food, paints, asphalt, petroleum and flour. I, 3. Prof. Chesnut.

(14) **Toxicology.**—Lectures, recitations and laboratory work on the nature, effect and detection of poisons and their classification. II, 2. Prof. Chesnut.

(15) **Chemistry of Foods**—A laboratory and lecture course designed especially for students in the junior year of the Domestic Science course. I and II, 8. Prof. Chesnut and Mr. Burke.

(16) **Assaying**—An elective course in assaying is offered to seniors taking the chemistry group. Assays are made of lead, tin, gold and silver as found in various ores, and of gold, silver and lead bullion. The cyanide and chlorination processes are carefully studied during the latter part of the semester. One lecture and two laboratory periods. II, 3. Mr. Burke.

(17) **Seminar: Abstracting**—In order to develop in the student a habit of careful reading, each student will be required to make abstracts of articles on assigned subjects from the leading journals, and present them at weekly meetings of the students and department instructors where the topics are freely discussed. They are thus kept in touch with the progress of the science. I and II, .2 Prof. Chesnut.

(18) **Conferences**—Regular meetings for the discussion of the progress of the work of the various students in the laboratory. In this way students and instructors are made acquainted with each other's work, and the student is encouraged to greater effort. Prof. Chesnut.

(19 **Thesis**—In the early part of the senior year the student selects the subject for his graduating thesis. The work done must include a considerable amount of original research. II, 9. Prof. Chesnut.

DOMESTIC SCIENCE.

MISS HARKINS.
MISS BALLINGER.

(1) **General Cookery**—This course is required of all freshman girls. The object of the work is to familiarize the student with the most systematic, economical, healthful and attractive methods of preparing foods. Special attention is given to table decorations and serving of meals. Students who studied cooking in the preparatory course are given work in planning bills of fare and cooking demonstrations. I and II, 2. Miss Harkins.

(2) **Selection and Preparation of Food and Cooking Demonstrations**—The principles of diet and the relations of food to health are studied. Standard dietaries are examined and bills of fare planned. Each student gives two public demonstrations. I, 2. Miss Harkins.

(3) **Economy of Food**—Special attention is given to the economic side of the food question. Bills of fare are planned and carried out. The government bulletins are read, and the text book is Richard's Cost of Living. II, 2. Miss Harkins.

(4) **Home Architecture and Sanitation**—The surroundings, situation and plan of the house, heating, lighting, plumbing and drainage. I, 2. Miss Harkins.

(5) **Home Nursing and Invalid Cookery.** II, 2. Miss Harkins.

(6) **Journal Meetings**—Topics relating to domestic science will be assigned and discussed. Articles in magazines will be reviewed. I, 3. Miss Harkins.

(7) **Sewing**—This work is required of all sophomore girls. The work is carefully graded to the capability of the student. At least three plain garments, a shirt waist and an unlined dress must be completed. I, 2. Miss Ballinger.

(8) **Sewing**—Drafting, cutting and fitting and plain dress making. II, 2. Miss Ballinger.

(9) **Sewing**—General dress making. I, 2. Miss Ballinger.

(10) **Sewing—Art needlework.** During the second semester the graduation dress will be made. II, 3. Miss Ballinger

(11) **Thesis**—In the beginning of the senior year the student selects her subject for graduating thesis. This must be along the line of domestic science or the application of chemistry or biology to domestic science. Miss Harkins.

ENGLISH.

PROF. BREWER.

In all the courses in English, written work plays an important part. That this work may be kept up to a proper grade, it is announced here that in college English work no paper will receive any credit that shows notable carelessness or ignorance in elementary matters of punctuation, grammar, rhetoric, or in the spelling of common words.

(1) **Composition**—This course is required of all freshmen. The course is almost altogether practice in various types of prose composition—narration, description, exposition, criticism and argumentation. The class meets ordinarily once a week. The instructor from time to time meets each student for private conference about his work. I and II, 4.

(2) This is a course in expository writing for those students who are specializing in other subjects. Papers not extremely technical, prepared for work in other courses may also be handed in as part of the work of this course. The teaching will be altogether individual. I and II, 4.

(3) This is an advanced course for those who wish to study composition as a fine art. It will include a study of the historical development of English prose style and such other work as may suit the taste or needs of those who elect the course. I and II, 4.

(10) **English Literature**—A reading course from Chaucer to the present day. A large amount of reading will be required and more recommended. Written reports are required frequently. A part of the class room time will be given to critical reading of English masterpieces. This course is required of all candidates for the bachelor's degree in science. I and II, 4.

(11) This course in English literature is varied each year, so that it may be elected two years in succession. The course will be a detailed study of some limited period of English literature or the history of some special form.

GEOLOGY.

PROF. CHESNUT.

(1) Geology—Lectures in connection with the use of LeConte's Elements of Geology as a text occupy one semester. The work is divided into dynamical, structural and historical geology, and includes practice in the identification of the age of rock by fossils, stratigraphical work in the field and identification of the crystalline rocks by microscopical examination. The fact that the Livingston and Three Forks folios issued by the United States Geological Survey cover the region immediately surrounding us shows how favorably we are situated for field work in geology under the best conditions.

We have within a few miles of the college not only stratified rocks covering great ranges of geological time but we have also many of the eruptives which have been carefully studied and described by expert geologists. The course in geology is given only in alternate years. It will not be given in 1906-1907. I, 5.

(2) Economic Geology—Lectures are given on the following general headings: Ore deposits, classification, genesis, occurrence; abrasive materials; natural salts; gems; limes; cement anl artificial stone; pigments; water; phosphates; clays used for pottery, porcelain, etc.; sands for glass; soils and miscellaneous topics. II, 3.

(3) Mineralogy—Lectures upon mineralogy are given, and in conferences the attention of the student is directed to the characteristics of each of the minerals whose identification is required, its resemblance to other minerals and its differences. The lectures deal with all those properties which can be distinguished without apparatus, the chemical composition and tests being only incidentally treated. Later, in determinative mineralogy, unknown minerals are given, and by the application of the chemical tests of blowpipe analysis, and his knowledge of theoretical mineralogy and crystallography, the student identifies the specimens.

The specimens used in this course consist of a large collection illustrating the minerals of economic importance and their associates.

The students also have access to the very extensive collections of the college. II, 2. (First nine weeks.)

(4) Crystallography—Crystallography is taught by the aid of a set of models which illustrate the more important crystalline forms and their modifications. The models cover all the forms of which knowledge is necessary for the student of mineralogy and the student becomes thoroughly familiar with each of them. II, 1. (First nine weeks.)

HISTORY.

MISS BREWER.

(1) European History—It is taken for granted that the student has had a preparatory course in general history with some such text as Myers or West. In this course special attention will be paid to the development of one or two European States. I and II, 4.

(2) Medieval History—The student is expected to have had courses which have given him knowledge of the great epochs in history and their relations to each other. Therefore, in this course he will take up the thorough study of one period. He will be encouraged to form his own opinions by the use of such historical sources of this period as are available in transalations. In this connection the student will be given practice in application of the fundamental principles used in testing the value of historical material. I and II, 4.

(3) American History—This is a course in United States history covering the period of constitutional development and with special reference to that development. The use of the library rather than any textbook is required in this course, and the student is expected to spend about

one-fourth of the time in the preparation of a paper on some selected subject. Course (2) should precede this course. I and II, 8.

(6) Thesis—For research work in his senior year the student is allowed to select any historical subject which he is qualified to investigate; and for which some material is available, either in translation or original.

LATIN.

PROF. BREWER.
MISS BREWER.

(1) Cicero—The four orations against Catiline are read, and two others. Roman politics, as compared with those of our day, always interest students who have an intelligent interest in current events, and there is every opportunity for such comparative study in this work. I and II, 8.
Miss Brewer.

(2) Virgil—The first six books of the Aeneid are read. Metrical reading of the Latin is required constantly. The students are encouraged to make metrical translations and paraphrases. I and II, 8. Prof. Brewer.

(3) Livy and Horace—The special aim in this year's work, as in the previous course, is to enable the student to acquire facility in reading and to instruct him in the use of Latin texts as a means of acquiring knowledge of the public and private life of the Romans; but grammatical study and literary criticism will not be neglected. I and II, 4.
Miss Brewer.

MATHEMATICS.

PROF. TALLMAN.

(1) Algebra—Beginning with a review of radicals and quadratic equations, the course includes progressions, arrangements and groups, binomial theorem, theory of limits, undetermined coefficients, logarithms, and an introduction to the theory of equations. I, 3.

(2) Plane Trigonometry, I. 2.

(3) Analytic Geometry—Straight line and conic sections, with an introduction to the geometry of three dimensions. II, 4.

(4) Calculus—Both differential and integral, with applications to as many practical problems as possible. I and II, 10.

(5) Method of Least Squares—I, 2.

(6) Theoretical Astronomy—Integration of equations of motion, computation of orbits and ephemerides. This course should be preceded by course (5) in Physics and must be preceded by course (4) in Mathematics. II, 3.

(10) **Differential Equations**—Ordinary and partial differential equations with geometrical and mechanical applications. I and II, 6.

(11) **Partial Differential Equations of Math. Physics**—This course will be based on Weber's "Die Partiellen Differential Gleichungen der Mathematischen Physik" and Byerly's "Spherical Harmonics." A great many applications to concrete problems will be made throughout the course. I and II, 6.

(12) **Newtonian Potential**—Lectures on the theory of potential with an introduction to spherical harmonics. I and II, 4.

(13) **Algebra (advanced))**—This course will be an extension of course (1), and will contain discussions of complex numbers, theory of algebraic functions, etc. Care will be taken to show the practical application of each subject as the work advances; that is, such subjects as the connections between complex numbers and alternating currents, etc., will be fully explained. I and II, 6.

(14) **Analytical Geometry (advanced)**—This course is a continuation of course 3. As the time given in course 3 for geometry of three dimensions is very limited it will receive considerable attention in this course. I and II, 6.

(15) **Thesis**—Students in the mathematical group are required to present a thesis on some chosen subject. The subject must be chosen and approved not later than November 15 of the senior year. A great deal of work in this line is desired, as it is believed there is no better way of developing a habit of independent thought.

(16) **Mathematico-Physical Seminary**—During the year students and members of the faculty especially interested in these subjects will meet once a week to review articles of interest in the current magazines, to present from time to time results of original research which is being carried on, etc. Students in the mathematical group are required to attend.

Only part of courses (10) to (14) will be given each year, those being chosen for which most students apply. The special object of our work here is to make the courses in applied mathematics complete, and the work in pure mathematics will have as its object the laying of a good foundation for the more advanced work in applied mathematics. Those desiring to do work which is not offered in the above courses may consult the professor in charge of the department.

MODERN LANGUAGES.

PROF. CURRIER.

(1) **French**—The study of French is begun in the freshman year, and the first year's work includes thorough study of the elements of grammar, careful reading, with translation of 300 pages of easy French, composition, practice in pronunciation and oral reading. Fair facility in sight reading is expected at the close of the year. I and II, 8.

(2) **French**—In the sophomore year, in addition to easy texts and further study of grammar and composition, specimens of the classics, prose and poetry will be read, and also some scientific French, thus cultivating in the student an appreciation of the best foreign literature. The chief aim of the course is acquisition of practical reading knowledge. I and II, 6.

(3) **French**—An elective course in the French classic drama and nineteenth century fiction is offered to juniors and seniors. I and II, 6.

(1.) **German**—This course is open to college students who have not had high school or preparatory German. The work of the first year includes careful study of the elements of grammar, composition, pronunciation, conversation, of easy texts, and sight reading. I and II, 8.

(2.) **German**—A continuation of above course. The work consists largely of reading of a practical nature, with some introduction to the classics. Further attention will be paid to grammar and composition. If demanded, scientific German will be read. I and II, 8.

(3.) **German**—The freshman work in German is a continuation of the course offered in the preparatory department, and can be taken only by students who have had two years of German previously. The classics will be studied; also, scientific texts if desired, and some attention will be given to composition and conversation. I and II, 8.

(4) **German**—An elective course offered to those who have completed course 2 or 3. It consists chiefly of advanced reading of a practical, scientific or literary character, as the needs of students electing it may dictate. I and I, 4.

PHYSICS.

PROF. COBLEIGH.

(1a.)—**General Descriptive Physics**—Two lectures and laboratory work two hours per week in mechanics, sound, heat, light, electricity and magnetism.This course is arranged to suit the needs of students in the course in agriculture and students in the chemical, biological and other general science groups who do not elect course (1 and 2). Mathematics (2) is pre-requisite. Text books: Physics, by Mann & Twiss; Laboratory Course, by Sabine; Laboratory Physics, by Miller. I and II, 6.

(1.) **General Physics**—Lectures, recitations and assigned problems three hours per week throughout the year on mechanics, heat, magnetism and electricity. This course is more mathematical and technical in its nature than physics (1a), and is particularly designed to meet the needs of students in engineering and the general science students in the mathematics and physics group. Mathematics (2) is pre-requisite, and (3 and 4) must be taken during the same year or in a previous year. Text book: Hastings & Beach's General Physics. I and II, 6.

(2). **Physical Measurements**—A laboratory course designed to supplement physics (1). It is strictly quantitative and is given for the purpose of providing laboratory illustrations of fundamental principles of the science and to train the student in making measurements of precision. The requirements are the same as for course (1). Text books: Mechanics, Molecular Physics and Heat, by Millikan; Laboratory Physics, by Miller. I and II, 4.

(3). **Electricity and Magnetism**—Lectures, recitations and problems, two hours per week on the elementary mathematical theory of electricity and magnetism, electrical units and laboratory methods. Required of students in electrical and mechanical engineering and in the mathematics and physics group. Physics (1 and 2) are pre-requisite. Text book: Electricity and Magnetism, by Gerard. I, 2.

(4). **Electrical Measurements**—A laboratory course supplementing course (3). It consists of exact measurements of resistance, electromotive force, current, capacity, and self-induction, calibration of commercial measuring instruments, insulation tests, battery testing and magnetic measurements, including determinations of the permeability and hysteresis of samples of iron. Requirements are the same as for course (3). I, 2.

(5) **Light and Sound**—A continuation of courses (1 and 2). The lectures and four hours' laboratory work per week during second semester of the junior year. II, 4.

(6). **Advanced Physics**—Conferences, assigned reading and laboratory work on problems arranged according to the needs of individual students. Pre-requisites are physics (1, 2, 3, 4 and 5).

A short course in processes, useful in the laboratory, will be given as a part of physics (6). It will include glass-blowing, cutting, grinding and polishing, preparation of fibres for suspensions, silvering glass, purifying mercury, photography, and elementary lathe work. I and II, 6.

(7). **Thesis**—Students in the mathematics and physics group, who elect physics as their major subject, are required in the senior year to prepare a graduating thesis on some subject which will involve considerable laboratory work and as much originality as possible.

POLITICAL AND SOCIAL SCIENCE.

PROF. BREWER.

(1). **Constitution of the United States**—One semester is given to the study of Bryce's American Commonwealth. The aim of the course will be to give a clear idea of the present day working of our government, and the problems that confront it; and to study intelligently contemporary questions of public life. II, 2.

(2). **Sociology**—The origin and history of human society, the various social theories and the laws of human intercourse are treated. Attention is given to such practical subjects as the government of cities, settlement work, the enrichment of country life, and charity work. Elective, I 3.

PUBLIC SPEAKING.

MRS. HALL.

Two meetings a week will be devoted to the study of vocal expression. The work will be co-ordinate with that required in English, (1); examples of description, narration, exposition and argumentation will be developed in extemporaneous speeches, with special attention to model briefs for debate. A few recitation periods will be devoted to a review of parliamentary law. The second semester will be devoted to voice culture and the study of oratory. I and II, 2.

COLLEGE PUBLICATIONS.

The college issues the following publications any or all of which will be sent to any address upon application as soon as issued. Address J. M. Hamilton, President, Bozeman, Montana.

General Information.—Including a full account of the organization of the college, a description of its buildings and equipment, a full statement of fees, and a list of students.

General Science.—The work in general science arranged according to the group system leads to the degree of B. S. The student selects one of the groups of studies arranged about each of the following subjects: Biology, Chemistry, Domestic Science, Mathematics and Physics, History, and Literature.

Agriculture.—A full outline of the college course in agriculture, leading to the degree of Bachelor of Scientific Agriculture, with an account of the studies pursued.

Engineering.—An outline of the courses in mechanical, electrical and civil engineering, leading respectively to the degrees of Bachelor of Mechanical, Electrical and Civil Engineering, with an account of the subjects studied in each course.

Preparatory Department.—Outlines of the preparatory courses, Academic, Agricultural, Domestic Economy and Manual Training, any one of which prepares for any of the college courses.

Business.—An outline of work in bookkeeping, business practice, stenography and typewriting with related work in English, penmanship, commercial law and other branches.

Art.—An outline of the work in art, providing a course of four years, more or less, with a description of methods and equipment.

Domestic Science.—An account of all the work offered in domestic science, both in one year, preparatory, and four year courses.

Music.—A full account of the work offered in the piano department, the violin department and in the vocal department, with statement of the fees. The tuition in these departments is charged separately.

Winter Courses.—An account of winter courses in agriculture and engineering, which will begin November 13 and end March 29. These courses have no requirements for entrance, the fees are smaller than for the other courses and the work is intended to be immediately practical. This bulletin will be issued in September, 1906.

Bulletin of THE MONTANA STATE COLLEGE *of* AGRICULTURE *and* MECHANIC ARTS.

FOUNDED EIGHTEEN HUNDRED NINETY-THREE

Volume 3. *Number* 5

College Courses in Agriculture.

Published Monthly by the College
During the College Year. . . .
FEBRUARY 1, 1906

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FACULTY IN AGRICULTURAL COURSE.

JAMES M. HAMILTON, M. S., (Union Christian College), **President.**
Professor of Philosophy and Economics.

FREDERICK B. LINFIELD, B. S. A. (Ontario Agr. Col.),
Professor of Animal Industry.

WILLIAM J. ELLIOTT, B. S. A. (Ontarion Agr. Col.),
Professor of Dairying.

ALFRED ATKINSON, B. S. A. (Iowa State Col.),
Professor of Agronomy.

ROY W. FISHER, B. S. (Univ. of Idaho),
Assistant Professor of Horticulture.

HENRY C. GARDINER, M. D. C. (Chi. Vet. Col),
Instructor in Veterinary Science.

OTHER DEPARTMENTS GIVING INSTRUCTION.

WILLIAM F. BREWER, A. M., (Harvard University),
Professor of Latin and English.

AARON H. CURRIER, A. M., (Oberlin College),
Professor of French and German.

ROBERT A. COOLEY, B. S., (Massaschusetts Agri. Col.),
Professor of Zoology and Entomology.

WILLIAM D. TALLMAN, B. S., (University of Wisconsin),
Professor of Mathematics.

WILLIAM M. COBLEIGH, A. M., (Columbia University),
Professor of Physics.

VICTOR K. CHESNUT, B. S., (University of California),
Professor of Chemistry and Geology.

E. TAPPAN TANNATT ,B. S., (Wash. State Col.),
Professor of Civil Engineering.

EDMUND BURKE,
Instructor in Chemistry.

WYATT W. JONES, S. B., (Harvard University),
Instrctor in Botany.

THE COLLEGE COURSE IN AGRICULTURE.

The agricultural courses are arranged especially for the education and scientific training of agriculturists.

In the college course the student is given that fundamental knowledge of science which will enable him to understand and grapple with the deeper problems in agricultural practice. In the junior and senior years, opportunity is afforded to specialize either in Agronomy, in Animal Industry, in Dairying or in Horticulture.

This course, moreover, is designed not alone to give special agricultural training but to give a broad scientific education. The farmer in America is both proprietor and manager of his farm, and is, moreover, a citizen in a country where the citizen is souvereign. The education of such a man should be broad and suggestive. The agricultural course as arranged brings the student into contact with nearly all the specialists of the college and opens to him many fields that invite future study and research.

The course is not arrangedas a manual training course. As practically all the students are from the farm, it is assumed that they are acquainted with the various manual operations of farm work. The aim, therefore, is to supplement this work by that technical training which as a rule the farm does not afford. Special emphasis is laid on the training of the faculties of observation, reason and judgment and from the first year of the course the student is made acquainted with those matters that will enable him to study profitably and with interest the best books and papers on agricultural topics.

The general and departmental libraries enable the student to become acquainted with a wide range of agricultural and related literature, while the laboratories of the College and Experiment Station afford opportunity for training and experience that it would be impossible to get from books. The outline of the course and the studies prescribed will give a fuller understanding of the work offered.

A thesis will be required in each of the agricultural courses based on some line of original work to be arranged with the head of the departments.

The electives may be selected from any course offered by the college that the student is prepared to take.

ALL AGRICULTURAL COURSES.

Freshman.

English (1)	2	English (1)	2
Chemistry (1)	4	Chemistry (1 and 2)	4
French (1) or German (1) or (3)	4	French (1) or German (1) or (3)	4
Farm Dairying (1)	3	Botany (9)	4
Trigonometry and Logarithms (2)	3	Mineralogy	2
Animal Types (1)	3	Breeds of Live Stock (2)	3
Drill	1	Drill	1
	20		20

. Sophomore.

English (10)	2	English (10)	2
Organic Chemistry (10)	3	Organic Chemistry (11)	3
Biology (1a)	5	Biology (2)	5
Crop Production (1)	3	Field Crops (2)	3
Physics (1a)	3	Botany (10)	4
Principles of Horticulture (1)	3	Forestry (2)	3
Drill	1	Drill	1
	20		21

AGRONOMY COURSE.

Junior Year.

English (2)	2	English (2)	2
Soil Physics (3)	5	Soil Fertility (4)	3
Plane Surveying (1)	4	Bacteriology (12)	4
Irrigation and Drainage (5)	3	Feeding of Live Stock (4)	4
Stock Judging (3)	1	Farm Mechanics (5)	3
Plant Diseases (11)	1	Elective	3
	19		19

Senior Year.

Farm Management (6)	3	Economic Entomology (5)	4
Economics (3)	2	Economics (3)	2
Improvement of Field Crops (7)	4	Farm Sanitation (5)	3
History of Agriculture (8)	3	Field Experimentation (9)	3
Thesis	2	Thesis	2
Elective	5	Elective	5
	19		19

ANIMAL INDUSTRY COURSE.

Junior Year.

Judging Live Stock (3)	1	Judging Live Stock (3)	1
Animal Physiology (3)	4	Feeding Live Stock (4)	4
Milk Production (2)	4	Veterinary Science (1 and 2)	3
Soil Physics (3)	5	Soil Fertility (4)	3
Poultry (10)	2	Bacteriology (12)	4
English (2)	2	Farm Mechanics (5)	3
		English (2)	2
	19		20

Senior Year.

Principles of Breeding (5)	3	Advanced Stock Judging (7)	2
Herd Books & Pedigrees (6)	1	Management of Live Stock (8)	3
Veterinary Science (3 and 4)	3	Veterinary Science (7 and 8)	3
Farm Management (6)	3	Farm Sanitation (Vet. 5)	3
Thesis	2	Methods of Live Stock Experimentation (9)	2
Elective	7	Thesis	2
		Elective	4
	19		19

DAIRY COURSE.

Junior Year.

Milk Production (2)	4	Advanced Butter Making (3)	3
Animal Physiology (3)	4	Feeding Live Stock (4)	4
Judging Live Stock (3)	1	Bacteriology (12)	4
Poultry (10)	3	Veterinary Science (1 and 2)	3
Soil Physics (3)	5	Farm Mechanics (5)	3
English (2)	2	Stock Judging (3)	1
		English (2)	2
	19		20

Senior Year.

Dairy Bacteriology (4)	4	Factory Management (7)	3
Scoring Butter and Cheese (6)	1	Cheese Making (5)	2
Principles of Breeding (5)	3	Veterinary Science (7 and 8)	3
Veterinary Science (3 and 4)	3	Management of Live Stock (8)	3
Farm Management (6)	3	Farm Sanitation (Vet 5)	3
Thesis	2	Thesis	2
Elective	3	Elective	3
	19		19

HORTICULTURAL COURSE.

Junior Year.

English (2)	2	English (2)	2
Soil Physics (3)	5	Soil Fertility (4)	3
Pomology (3)	3	Principles of Vegetable Gardening (5)	3
Plant Diseases (11)	4	General Entomology (4)	4
Nursery Practice (4)	2	Bacteriology (12)	4
Plane Surveying (1)	4	Elective	3
	20		19

Senior Year.

Farm Management (6)	3	Plant Breeding (8)	4
Economics (3)	2	Economics (3)	2
Evolution of Cult. Plants (6)	3	Landscape Horticulture (9)	3
Irrigation and Drainage (5)	3	Review of Horticultural Literature (10)	2
Greenhouse Construction and Management (7)	3	Economic Entomology (5)	4
Thesis	2	Thesis	2
Elective	3	Elective	2
	19		19

AGRONOMY.

PROFESSOR ATKINSON.

(1) **Crop Production**—Reproduction, germination and growth. Vitality and germination of seeds with circumstances influencing these; conditions of plant growth, peculiarities of the different agricultural plants in respect to structure, habits, and requirements for successful growth. I, 3

(2) **Field Crops**—A study of the crops of the farm, grain crops, forage crops, root crops ,sugar and fiber crops—their history and distribution over the earth, methods of culture, cost of production, consumption of products and residues or by-products. In this course considerable time is spent in score card practice in the grain judging laboratory. II, 3.

(3) **Soil Physics**—This course is designed to prepare the students to better understand the effects of the different methods of treatment of soils, and the influence of these upon moisture, texture aeration, fertility and production. It comprises a review of the origin, formation and classification of soils and a study of the conditions influencing the supply of heat, air and moisture as related to growing plants. The work of the class room is supplemented by laboratory work comprising the determination of such questions as the water holding capacity and capillary power of various soils; the effect of mulches and of various systems of rotations on the physical condition of the soil. I, 5.

(4) **Soil Fertility**—Maintenance of fertility, fertilizers and rotation. The influence of barnyard manure, green manuring and commercial fertilizers upon the quality and yield of the various crops. The effects of different crops upon the fertility of the soil and upon succeeding crops; different rotations and the ultimate effect of different methods of farm management upon the fertility and productive capacity of the soil; also a study of the preservation and application of barnyard manure. II, 4.

(5) **Farm Mechanics**—A study of the construction of farm machines. Binders, mowers, cleaners and other farm machines will be taken apart and assembled by the students.

The location of buildings and methods of laying out the farm will be discussed; also the construction of fences and the testing of fence materials. II, 3.

(6) **Farm Management**—This course considers the problems of farm management ,and the relative profits of different systems of farm management; the relation of the industry of agriculture to other industries, and the social conditions of agriculture are considered. I, 3.

(7) **Improvement of Field Crops**—This course includes a study of the principles that underlie the development and breeding of field crops. I, 4.

(8) **History of Agriculture**—A study of the development of agriculture from the dawn of civilization, considering farming as carried on by the

Greeks and Romans; through the middle ages; feudal farming and the dawn of modern methods and practices in agriculture. I, 3.

(9) **Field Experimentation**—This course comprises a study of the methods of presenting the results of field experiments; also a study of the plans and methods used in field crop experimentation, with methods for keeping records. II, 3.

ANIMAL INDUSTRY.

PROFESSOR LINFIELD.

PROFESSOR ELLIOTT.

(1) **Animal Types**—A study of type as related to production and work. This course covers the judging of the different market classes of cattle (beef and dairy), of sheep (mutton and wool), or horses (light and heavy), and of hogs (bacon and fat). One half the time of this course is given to practical handling and judging of the stock in the stock pavilion. I, 3.

(2) **Breeds of Live Stock**—The zoological relation of the domestic animals to the rest of the animal kingdom will be taken up. A study of the development of the breeds of horses, cattle, hogs and sheep will illustrate the principles and particular characteristics that distinguish one breed from another and will show the adaptability of each particular breed to various climates, conditions and purposes.

These lectures will be illustrated by stereopticon views of characteristic animals of the different breeds. Lecture 2 lab. 1. II, 3.

(3) **Judging Live Stock**—This is a critical study of the different breeds of live stock from a study of living animals. One afternoon a week in stock judging pavilion for the year. I and II, 2.

(4) **Feeding of Animals**—The principles underlying the profitable feeding of animals. The composition of plants, animals and animal products. The practices which give best results as indicated by available data gathered from the work of experiment stations in this and other countries. II, 4.

(5) **Principles of Breeding**—A study of the laws of heredity, of correlation, reversion, variation, selection, and methods of grading ,crossing, in-and-in breeding, etc. The application of these laws is illustrated by reference to the practices of noted improvers of animals and plants. The students are shown how these laws may be taken advantage of in improving the live stock of the farm. I, 3.

(6) **Herd Books and Pedigrees**—This is largely a laboratory study of the herd books of the different breeds of live stock. The tabulation of pedigrees and such other exercises as will enable the student to learn the

value of a pedigree and show how to keep the record of a breeding herd. I, 1.

(7) **Advanced Stock Judging**—Animal measurements and the systematic study of animal form, function and performance; the aim being to give exact and intimate acquaintance with the detail form of specialized types, a knowledge that is essential to the highest success in selection and breeding; also some systematic work in the judging of groups of cattle, horses, sheep and swine, similar to those found at county and state fairs. II, 2.

(8) **Care and Management of Live Stock**—A special study of the methods to be followed in the breeding, feeding and development of the various classes of live stock as illustrated from the practices of the most successful live stock breeders. II, 3.

(9) **Method of Live Stock Experimentation**—This is a study of Experiment Station literature along the lines of live stock experiments to enable the student to get acquainted with the methods pursued in those investigations. II, 2.

(10) **Poultry**—Breeds and management; poultry houses; feeding and care of poultry; the operation of incubators and brooders. I, 3.

DAIRYING.

PROFESSOR ELLIOTT.

(1) **Farm Dairying**—This course will consist of 2 lectures and 1 laboratory and will comprise a study of the subject of dairying in its general relation to the farm. The class work takes up production of milk, separation of cream by gravity and separator, the use of the Babcock test with the herd, preparation of "starters," the ripening, churning and packing of butter, and general sanitary methods necessary on the farm in milk production. I, 3.

(2) **Milk and Milk Testing**—This course will comprise a study of milk, its secretion, composition and uses, the pasteurization, separation and handling for city milk trade and for creamery or cheese factory; also the testing of milk for variations and adulterations ,the testing of butter and cheese, and the use of the acidometer. 2 Lectures and 2 laboratory. I, 4.

(3) **Advanced Butter Making**—This comprises a detailed and thorough study of the physical and chemical properties of milk and its components; of the principles of separation of cream by gravity and centrifugal separators ,the effect of the different degrees of acidity of cream upon the quality of the butter, and the principles of churning, packing and marketing butter. The laboratory periods are devoted to practical work in the creamery and the operation of the leading types of separators and churns

and the preparation of tubs and butter so as to secure the best keeping quality. 2 lectures and 1 lab. II, 3.

(4) **Dairy Bacteriology**—This course will comprise a study of the relation of bacterial life to milk and to milk products. The question of the bacterial infection of milk and methods of prevention; fermentations in milk and their treatment. Disease producing bacteria in milk, perservation of milk with especial reference to pasteurization. The bacteria in fluid products of milk, butter and cheese. 3 lectures and 1 lab. I, 4.

(5) **Cheese Making**—The equipment for factory or home cheesemaking, the principles and practice necessary to make a uniform article and methods used to overcome characteristic differences are explained and illustrated in the classroom and laboratory.

All common varieties of cheese such as Cheddar, Swiss, Brick, Limburger, and other varieties are discussed, and as far as possible made in the classroom, but the Cheddar cheesemaking is particularly emphasized. II, 2.

(6) **Scoring Butter and Cheese**—This course is designed to give the student a correct idea of the standard market requirements for dairy products. Butter and cheese are examined and scored by the student and their judgment compared with the instructors'. 1 lab. I, 1.

(7) **Factory Management**—The location, organization, construction, arrangement, apparatus, the equipment and operation of farmer's co-operative or private enterprise creameries or cheese factories. Methods of paying for milk and cream, and the preparation of plans for home dairy or co-operative factory. II, 3.

HORTICULTURE.

ASSISTANT PROFESSOR FISHER.

(1) **Principles of Horticulture**—This course will deal with the principles underlying the various horticultural operations; variation, selection and crossing of plants with reference to plant improvement. The methods of pruning, cultivation, gathering and marketing of fruits and vegetables are studied along with the principles involved in each case. I, 3.

(2) **Forestry**—The influence of forests on climate, soil and flow of streams is studied. The characteristics and uses of typical woods; the management and preservation of forests, with a special study of the forest trees native to this state, are phases of this work. II, 3.

(3) **Pomology**—This course deals with the principles and methods of fruit growing. The methods of propagating fruit trees and shrubs, pruning, cultivating and the general management of fruit plantations are considered. A systematic study of all Northwestern fruits is made. I, 3.

(4) **Nursery Practice**—A two-credit course dealing with the methods and principles of growing fruit and ornamental trees and shrubs in nurseries. I, 3.

(5) **Principles of Vegetable Gardening**—Lectures and practice; treating of the principles and methods of growing vegetables under glass and in the field; particular attention being given to the vegetables suited to Montana conditions.I I, 3.

(6) **Evolution of Cultivated Plants**—Lectures and text-book work on evolution relating to the cultivated horticultural plants. I, 3.

(7) **Greenhouse Construction and Management**—The construction, heating and maintaining of greenhouses, with lectures, and practicums treating of the methods of growing plants in greenhouses and conservatories. I, 3.

(8) **Plant Breeding**—Lectures, text-book and practice. This subject deals with the principles and methods of improving plants by cross pollenating, selection, etc. II, 4.

(9) **Landscape Horticulture**—The laying out and planting of private and public grounds are discussed. The trees, shrubs and flowers suited to our Montana conditions are studied. II, 3.

(10) **Review of Horticultural Literature**—Two hours per week in one semester of the senior year are given in class to the discussion of literature pertaining to horticulture. Experiment Station bulletins, current horticultural papers, magazines and books are reviewed. II, 2.

VETERINARY SCIENCE.

DR. GARDINER.

(1) **Anatomy**—Lectures describing the locomotory apparatus, including bones, articulations and muscles; also careful description of the viscera, blood vessels, nerves, and organs of special sense. The horse will be taken as a type. Laboratory dissection.

(2) **Comparative Anatomy and Physiology**—A more advanced and thorough consideration of the anatomical structure with special reference to the comparative anatomy and physiology of the horse, ox, sheep and hogs. Laboratory dissection. I.

(3) **Pathology**—General pathology, consisting of a brief course in morbid anatomy and histology. Lab. Clinic.

(4) **Materia Medica**—This work will include a consideration of the common remedies used in the treatment of diseases. A few lectures on toxicology and serum therapeutics. Lab. tuberculin testing, mallein testing, vaccination and immunization. II.

(5) **Farm Sanitation**—A comprehensive course in general sanitation

relating to sources of water, milk, and food supplies, sewage disposal, source and spread of infectious diseases both of man and animals, the prevention and inhibition of infection, decomposition, and decay. A study of asepsis, antisepsis, disinfection and disinfectants.

(6) **Common Diseases of Farm Animals**—Etiology, Prophylaxis, diagnosis and treatment. Clinic; examination of the horse for soundness, study of lameness and shoeing. I.

(7) **Obstetrics**—Lectures on obstetrical anatomy and physiology, pathology of gestation, normal parturition and dystokia. Clinic.

(8) **Parasitology**—Study of parasites of domestic animals with treatment. 2nd semester. 1.

(9) **Infectous Diseases of Farm Animals**—Etiology, prophylaxis, diagnosis, treatment and eradication. This course will also include a few lectures on government control and supervision of diseases of livestock. II.

SUBJECTS OFFERED BY OTHER DEPARTMENTS.*

(3.) **Economics**—This course consists of a study of such questions as land, capital, labor, money, coinage, banking, rent, interest, wages and taxation. The most important questions in economics of the present time are considered. Among these may be mentioned trusts, labor organizations, government ownership of public utilities, co-operation, recent currency legislation and the single tax. Required of general science students. I and II,, 4. President Hamilton.

(1a) **Invertebrate Zoology.**—Devoted to a study of the invertebrate animals, including their morphology, development, habits, economic or popular interest and classification. The broad biological principles are brought out and emphasized. The class room work is based on Weysse's "Synoptic Text Book of Zoology." The laboratory exercises include a study of the morphology of types, reference reading and practical work in the classification of animals. Required of agriculture students and general science students except those in the mathematics and physics group. Class room exercises by Prof. Cooley. Laboratory work directed by Mr. Jones. I, 5.

(2.) **Vertebrate Zoology.**—A continuation of (1a) taking up vertebrate (Chordate) forms. Required of agriculture and biology students. Elective for those who have taken (1a) or (1b). II, 5. Prof. Cooley.

(3.) **Animal Physiology and Histology**—The student is required to prepare for microscopical study a series of tissues taken from the bodies of freshly killed animals and these slides, together with a large series owned by the department, form the basis of an extended study of animal tissues. By a series of lectures, supplemented by reading courses, the student is taught the main facts of animal physiology. Required of agriculture and biology group students. Elective for general science and domestic science students. I, 4. Prof. Cooley.

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*The numbers prefixed to these paragraphs are those by which they are designated in the more extended writeups in the General Science Bulletin.

(4.) **General Entomology**—Lectures on the morphology, metamorphoses and classification of insects and a study of the different orders. Collecting, naming, labelling and arranging in museum form species that are to be found in the vicinity of Bozeman. Required of biology group students. Elective for others who have taken 1a or 1b and 2. Two lecures and two laboratory exercises per week. II, 5. Prof. Cooley.

(5.) **Economic Entomology.**—A briefer account of the structure, metamorphoses and classification of insects followed by an extended study of the general principles underlying insect depredations together with an account of the more important insect pests of the garden, orchard and farm in Montana. Required of agriculture students. Three lectures and one laboratory exercise per week. II, 4. Prof. Cooley.

(9) **General Botany.**—Anatomy, morphology and classification of the higher plants. Flower analysis and the making of a small herbarium. Required of all agricultural and general science students. Two lectures and three laboratory exercises per week. II, 5. Mr. Jones.

(10.) **Plant Physiology and Histology.**—Essentials of the histology and physiology of the higher plants. Required of agricultural students. I, 4. Mr. ....

(11.) **Diseases of Plants.**—After a brief survey of cryptogamic plants the more important fungus diseases of Montana plants are studied, together with means for their control. II, 4.

(12.) **Bacteriology.**—An elementary study of the life history of bacteria, their growth in nutrient media and methods of analysis and classification. The part they play in agriculture, medicine and our daily life is discussed. Required of agriculture and domestic science students. Elective to others so far as the limited space and equipment will allow. II, 4.

(1) **Plane Surveying**—The use and adjustments of the ordinary surveying instruments, such as the compass, level, and transit. The theory and practice of land surveying and leveling; keeping of field notes and platting. Two hours recitation, four hours field work and platting. I, 4. Prof. Tannatt.

(5) **Irrigation and Drainage Engineering**—This includes the impounding, diverting, and conveying water, and its flumes, ditches; methods of measuring the duty of water, and its relation to the climate, soil, etc. Drainage of swamp and alkali land. Three hours recitation per week Part of the time of field practice is devoted to this study. I, 3. Prof. Tannatt.

(1) **General Inorganic Chemistry.**—Lectures with frequent recita-

tions are given on the general principles of chemistry. The properties, preparation and applications of the elements and their principal compounds are studied.

The first semester will be given to the stuly of the non-metals and the second semester to the metals. Throughout the year lecture experiments will be performed, illustrating general principles and quantitative relationships. Fr. I—II, 4. Mr. Burke.

(2.) **Laboratory Experiments**—Accompanying course (1) is this laboratory course which comprises the preparation, physical and chemical properties, and the tests of the principal elements and inorganic compounds. Qualitative analysis and some quantitative experiments are also included.

The first semester will be taken up with the study of the elements, compounds, and quantitative experiments and the second semester with the study of qualitative analysis. Fr. I, II, 4. Mr. Burke.

(10) **Organic Chemistry.**—Lectures and recitations on the simpler com pounds of carbon. Text book: Remsen's Introduction to the Study of the Compounds of Carbon. I, 3. Prof. Chesnut.

(11) **Laboratory: Organic Chemistry.**—A laboratory course to accompany course (10) and to familiarize the student with organic compounds and their manipulation. A series of chemically pure organic preparations will be made by each student. II, 3. Prof. Chesnut.

(1) **Composition**—This course is required of all freshmen. The course is almost altogether practice in various types of prose composition—narration, description, exposition, criticism and argumentation. The class meets ordinarily once a week. The instructor from time to time meets each student for private conference about his work. I and II, 4.

Prof. Brewer.

(2) This is a course in expository writing for those students who are specializing in other subjects. Papers not extremely technical ,prepared for work in other courses may also be handed in as part of the work of this course. The teaching will be altogether individual. I and II, 4.

Prof. Brewer.

(10) **English Literature**—A reading course from Chaucer to the present day. A large amount of reading will be required and more recommended. Written reports are required frequently. A part of the class room time will be given to critical reading of English masterpieces. This course is required of all candidates for the bachelor's degree in science. I and II, 4.

Prof. Brewer.

(3) **Mineralogy**—Lectures upon mineralogy are given, and in conferences the attention of the student is directed to the characteristics of each of the minerals whose identification is required, its resemblance to other minerals and its differences. The lectures deal with all those properties which can be distinguished without apparatus, the chemical composition and tests being only incidentally treated. Later, in determinative mineralogy, unknown minerals are given, and by the application of the chemical

tests of blowpipe analysis, and his knowledge of theoretical mineralogy and crystallography, the student identifies the specimens.

The specimens used in this course consist of a large collection illustrating the minerals of economic importance and their associates.

The students also have access to the very extensive collections of the college. II, 2. (First nine weeks.) Prof. Chesnut.

(2) Plane Trigonometry, I, 2. Prof. Tallman.

(1) French—The study of French is begun in the freshman year, and the first year's work includes thorough study of the elements of grammar, careful reading, with translation of 300 pages of easy French, composition, practice in pronunciation and oral reading. Fair facility in sight reading is expected at the close of the year. I and II, 8. Prof. Currier.

(1.) German—This course is open to college students who have not had high school or preparatory German. The work of the first year includes careful study of the elements of grammar, composition, pronunciation, conversation, of easy texts, and sight reading. I and II, 8.

Prof. Currier.

(3.) German—The freshman work in German is a continuation of the course offered in the preparatory department, and can be taken only by students who have had two years of German previously. The classics will be studied; also, scientific texts if desired, and some attention will be given to composition and conversation. I and II, 8. Prof. Currier.

(1a.)—**General Descriptive Physics**—Two lectures and laboratory work two hours per week in mechanics, sound, heat, light, electricity and magnetism.This course is arranged to suit the needs of students in the course in agriculture and students in the chemical, biological and other general science groups who do not elect course (1 and 2). Mathematics (2) is prerequisite. Text books: Physics, by Mann & Twiss; Laboratory Course, by Sabine; Laboratory Physics, by Miller. I and II, 6. Prof. Cobleigh.

COLLEGE PUBLICATIONS.

The college issues the following publications any or all of which will be sent to any address upon application as soon as issued. Address J. M. Hamilton, President, Bozeman, Montana.

General Information.—Including a full account of the organization of the college, a description of its buildings and equipment, a full statement of fees, and a list of students.

General Science.—The work in general science arranged according to the group system leads to the degree of B. S. The student selects one of the groups of studies arranged about each of the following subjects: Biology, Chemistry, Domestic Science, Mathematics and Physics, History, and Literature.

Agriculture.—A full outline of the college course in agriculture, leading to the degree of Bachelor of Scientific Agriculture, with an account of the studies pursued.

Engineering.—An outline of the courses in mechanical, electrical and civil engineering, leading respectively to the degrees of Bachelor of Mechanical, Electrical and Civil Engineering, with an account of the subjects studied in each course.

Preparatory Department.—Outlines of the preparatory courses, Academic, Agricultural, Domestic Economy and Manual Training, any one of which prepares for any of the college courses.

Business.—An outline of work in bookkeeping, business practice, stenography and typewriting with related work in English, penmanship, commercial law and other branches.

Art.—An outline of the work in art, providing a course of four years, more or less, with a description of methods and equipment.

Domestic Science.—An account of all the work offered in domestic science, both in one year, preparatory, and four year courses.

Music.—A full account of the work offered in the piano department, the violin department and in the vocal department, with statement of the fees. The tuition in these departments is charged separately.

Winter Courses.—An account of winter courses in agriculture and engineering, which will begin November 13 and end March 29. These courses have no requirements for entrance, the fees are smaller than for the other courses and the work is intended to be immediately practical. This bulletin will be issued in September, 1906.

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College Courses in Engineering

Published Monthly by the College
During the College Year. . . .
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ENGINEERING DEPARTMENT.

JAMES M. HAMILTON, M. S. (Union Christian Col.),
President.

JOSEPH A. THALER, E.E., (Univ. of Minn.).
Professor of Electrical Engineering.

GEORGE B. COUPER, M. E., (Univ. of Minn.),
Professor of Mechanical Engineering.

E. TAPPAN TANNATT, B. S. (Wash. State Col.),
Professor of Civil Engineering.

CHARLES S. DEARBORN, B. S., (Kansas State Agri. Col.),
Assistant Professor of Mechanical Engineering.

OTHER DEPARTMENTS GIVING INSTRUCTION.

WILLIAM F. BREWER, A. M., (Harvard University).
Professor of Latin and English.

AARON H. CURRIER, A. M., (Oberlin College).
Professor of French and German.

WILLIAM D. TALLMAN, B. S., (Univ. of Wis.),
Professor of Mathematics.

WILLIAM M. COBLEIGH, A. M., (Col. Univ.),
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VICTOR K. CHESNUT, B. S., (Univ. of Cal.),
Professor of Chemistry and Geology.

MRS. MABEL KINNEY HALL, Ph. B., (Oberlin Col.),
Instructor in Public Speaking.

EDMUND BURKE,
Instructor in Chemistry.

College Courses in Engineering

The purpose of the college courses in engineering is to furnish the student with the fundamental principles for a professional career, constructive work and the management of large enterprises.

These courses cannot be a substitute for actual experience; nor can they confer inventive genius, executive ability, or any of the other capacities which make the greatest professional engineers. But these courses should so train the student's capacities and inform his mind that his professional career would be the most successful of which he was capable, and that he would never be held back for the want of elementary knowledge or skill.

Upon entrance to the freshman class in engineering the student will select one of the three main lines offered here, mechanical, electrical, or civil engineering, but he may change, upon the consent of his class officer from one course to another at any time before the end of the freshman year. Up to the end of the freshman year the work is the same for all courses—foundation work in mathematics, language and science.

The fees and deposits in the freshman year of these courses are as follows: Matriculation, $12.00; deposit for chemistry, $8.00; deposit for shopwork, $6.00

The courses in mechanical, electrical and civil enginering lead respectively to the degrees of Bachelor of Mechanical, Electrcial or Civil Engineering. On the completion of one year of postgraduate work or three years of professional work and the presentation of an acceptable thesis, the college will confer upon the holders of bachelor's degrees in these three courses the degrees, respectively, of Mechanical Engineer, Electrical Engineer, or Civil Engineer.

ALL ENGINEERING COURSES.

Freshman Year.

First Semester.	Credits	Second Semester.	Credits
Algebra (1)	3	Analytical Geometry (3)	4
Trigonometry (2)	2	Descriptive Geometry (13)	2
German (1) or (3) or French (1)	4	German (1) or (3) or French (1)	4
Chemistry Lecture (1)	2	Chemistry Lectures (1)	2
Chemistry Laboratory (2)	2	Chemistry Laboratory (2)	2
Mechanical Drawing (11)	3	Mechanical Drawing (13a)	3
Joinery (12)	2	Foundry and Pattern Making (14)	2
Military Drill	1	Military Drill	1
	19		20

MECHANICAL ENGINEERING COURSE.

Sophomore Year.

First Semester	Credits	Second Semester	Credits
Calculus (4)	5	Calculus (4)	5
English (1)	2	English (1)	2
Public Speaking (1)	1	Public Speaking (1)	1
Physics (1)	3	Physics (1)	3
Physical Measurements (2)	2	Physical Measurements (2)	2
Kinematics (15)	2	Mechanical Drawing (17)	3
Mechanical Drawing (15a)	2	Forge Work (18)	2
Forge Work (16)	2	Military Drill	1
Military Drill	1		19
	20		

Junior Year.

First Semester	Credits	Second Semester	Credits
Mechanics (1)	4	Mechanics (2)	4
Physics (3)	2	Strength of Materials Lab. (24)	1
Elec. Meas. (4)	1	Ind. and Valve Gears (22)	2
Applied Electricity (1)	3	Steam Engines and Boilers (23)	2
Elec. Laboratory (2)	2	Machine Design (21)	3
Hydraulics (4)	3	Mechanical Drawing (21a)	3
Mechanical Drawing (19)	1	Mechanical Laboratory (22a)	1
Seminar (1)	1	Seminar (1)	1
Machine Work (20)	2	Machine Work (25)	2
	19		19

Senior Year.

First Semester	Credits	Second Semester	Credits
Thermodynamics (26)	3	Thermodynamics (26a)	2
Economics (5)	2	Economics (5)	2
Steam Boiler Design (27)	1	Steam Engine Design (30)	2
Mechanical Drawing (27a)	3	Contracts and Specifications (31)	1
Mechanical Laboratory (28)	3	Engineering Designs (9)	3
Machine Work (29)	2	Shop Management (32)	1
Seminar (1)	1	Mechanical Drawing (30a)	2
Thesis (33)	1	Seminar (1)	1
Electives	3	Thesis (33)	2
	19	Electives	3
			19

Electives:		Electives:	
Water Power Development (11)	3	Dynamos and Motors (3)	4
Foundations and Masonry (12)	2	Roofs and Bridges (17)	2
Fuel and Gas Analysis (4)	3	Fuel and Gas Analysis (4)	3

ELECTRICAL ENGINEERING COURSE

Sophomore Year.

First Semester	Credits	Second Semester	Credits
Calculus (4)	5	Calculus (4)	5
English (1)	2	English (1)	2
Public Speaking (1)	1	Public Speaking (1)	1
Physics (1)	3	Physics (1)	3
Physical Measurements (2)	2	Physical Measurements (2)	2
Forge Work (16)	2	Machine Design (21)	2
Drill (1)	1	Mechanical Drawing (17)	2
Electives	3 or 4	Forge Work (16)	1
		Drill (1)	1
	19 or 20		[illegible]

Electives:	
Kinematics (15)	2
Drawing (15a)	2
Field Work (9)	2
Surveying (1)	2
Iron and Steel Analysis	3

Junior Year

First Semester	Credits	Second Semester	Credits
Mechanics (1)	4	Mechanics (2)	4
Physics (3)	2	Strength of Materials Lab. (24)	1
Electrical Measurements (4)	2	Dynamos and Motors (3)	4
Applied Electricity (1)	3	Dynamo Design (6)	3
Electrical Lab. (2)	2	Electrical Lab. (4)	2
Electrical Diagrams (5)	2	Seminar (1)	1
Seminar (1)	1	Electives	3 or 4
Electives	3		18 or 19
	19		

Electives:		Electives	
Hydraulics (4)	3	Indicators and Valve Gears (22)	2
Iron and Steel Analysis (3)	3	Mechanical Lab. (22a)	1
Complex Numbers (13)	3	Light and Sound (5)	4
German or French (2)	3	Steam Engines and Boilers (23)	2
Machine Work (20)	3	German (4) or French (2)	3
English (2) or (10)	2	Machine Work (25)	2
		English (2) or (10)	2

Senior Year.

First Semester	Credits	Second Semester	Credits
Alternating Currents (7)	4	Alternating Currents (7)	4
Economics (5)	2	Economics (5)	2
Electrical Design (10)	3	Contracts and Specifications (9)	1
Electrical Lab. (8)	3	Electrical Design (10)	3
Plant Operation (11)	1	Electrical Lab. (8)	2
Seminar (1)	1	Seminar (1)	1
Thesis (12)	2	Thesis (12)	3
Electives	3	Electives	2 or 3
	19		19

Electives:		Electives:	
Thermodynamics (26)	3	Thermodynamics (26a)	3
Water Power Development (11)	3	Logic (4)	2
German (4) or French (2)	3	Political Science (1)	2
Differential Equations (10)	3	German (4) or French (2)	3
English (2) or (10)	2	Differential Equations (10)	3
		English (2) or (10)	2

CIVIL ENGINEERING COURSE.

Sophomore Year.

First Semester		Second Semester	
Calculus (4)	5	Calculus (4)	5
English (1)	2	English (1)	2
Public Speaking (1)	1	Public Speaking (1)	1
Physics (1)	3	Physics (1)	3
Physical Measurements (2)	2	Physical Measurements (2)	2
Plane Surveying (1)	2	Topographical and Railway Surveying (3)	3
Field Practice (9)	2	Field Work and Plotting (9)	2
Roads, Streets and Pavements (2)	1	Military Drill	1
Military Drill	1		
	19		19

Junior Year.

Mechanics (1)	4	Mechanics (2)	4
Hydraulics (4)	3	Strength of Materials Lab. (24)	1
Drainage and Irrigation Engineering (5)	3	Roofs and Bridges (17)	2
Field Practice (9)	3	Sanitary Engineering (6)	3
Seminar (1)	1	Cement Tests (7)	1
Elective	5	Storage Reservoirs and Dams (8)	2
	19	Engineering Design (9)	3
		Seminar (1)	1
		Electives	2
			19

Electives:		Electives:	
App. Elec. and Lab. (1) and (2)	5	Logic (4)	2
Geology (1)	5	Political Science (1)	2
German (4) or French (2)	3	Mineralogy (3)	2
Materials of Engineering (16a)	1	German (4) or French (2)	3
Iron and Steel Analysis (3)	3	Steam Engines and Boilers (23)	2
Forge Work (16)	2		

Senior Year.

Geodetic Surveying (10)	2	Hydrographic Surveying (13)	2
Economics (5)	2	Economics (5)	2
Water Power Development (11)	3	Contracts and Specifications (14)	2
Engineering Design (9)	3	Engineering Design (9)	3
Field Practice (9)	3	Cost of Construction (15)	2
Foundations and Masonry (12)	2	Practical Astronomy (16)	2
Seminar (1)	1	Seminar (1)	1
Elective	3	Thesis	5
Thesis			19
	19		

Electives:	
Thermo dynamics (26)	3
Materials of Engineering (16a)	1
Iron and Steel Analysis ()	3

DESCRIPTION OF SUBCOURSES*

Electives

(1) The electives offered in the engineering courses and which are given by other departments are described in the General Science Bulletin.

CHEMISTRY.

Prof. Chesnut.
Mr. Burke.

(1). **General Inorganic Chemistry.**—Lectures with frequent recitations are given on the general principles of chemistry. The properties, preparation and applications of the elements and their principal compounds are studied.

The first semester will be given to the study of the non-metals and the second semester to the metals. Throughout the year lecture experiments will be performed, illustrating general principles and quantitative relationships. Fr. I—II, 4

(2). **Laboratory Experiments**...Accompanying course I is this laboratory course which comprises the preparation, physical and chemical properties, and the tests of the principal elements and inorganic compounds. Qualitative analysis and some quantitative experiments are also included.

The first semester will be taken up with the study of the elements, compounds, and quantitative experiments and the second semester with the study of qualitative analysis. Fr. I, II, 4.

(3). **Iron and Steel Analysis.**—This work is intended to give the student a method of determining the properties of iron and steel and show how the presence of different elements affects the strength, magnetic properties, etc. The students are given preliminary work with known salts to develope the method of analysis after which they work upon iron and steel. Elective I, 3

(4). **Fuel and Gas Analysis.** A course in analyzing fuels with reference to their value as heat producers and of gases to determine the completeness of combustion. The students will first be given salts of known composition and after gaining some skill will take up the work with fuels and gases. Elective I, 3

ENGLISH

Prof. Brewer.

(1). **Composition.**—This course is required of all freshmen. The course is almost altogether practice in various types of prose composition —narration, description, exposition, criticism and argumentation. The

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*Figures in parenthesis indicate the number of subcourse. A credit consists of one hour of recitation or lecture, two hours of drawing or laboratory work, or two and one-half hours of shop work.

class meets ordinarily once a week. The instructor from time to time meets each student for private conference about this work.
Soph. I and II, 4.

MATHEMATICS

Prof. Tallman.

(1). **Algebra.**—Beginning with a review of radicals and quadratic equations, the course includes progressions, arrangements and groups, binomial theorem, theory of limits, undetermined coefficients, logarithms, and an introduction to the theory of equations. Fr. I, 3.

(2). **Plane Trigonometry.**—This is given during the second semester.
Fr. I, 2.

(3). **Analytical Geometry.**—Straight line and conic sections with an introduction to the geometry of three dimensions. Fresh. II, 4

(4). **Calculus**—Both differential and integral with applications to as many practical problems as possible. Soph. I, II, 10.

MODERN LANGUAGES.

Prof. Currier.

(1). **French.**—The study of French is begun in the freshman year, and the first year's work includes thorough study of the elements of grammar, careful reading ,with translation of 300 pages of easy French, composition, practice in pronunciation and oral reading. Fair facility in sight reading is expected at the close of the year. Fr. I. and II., 8.

(1). **German.**—This course is open to college students who have not had high school or preparatory German. The work of the first year includes careful study of the elements of grammar, composition, pronunciation, conversation, reading of easy texts, and sight reading.
Fr. I and II, 8.

(3). **German.**—The freshman work in German is a continuation of the course offered in the preparatory department, and can be taken only by students who have had two years of German previously. The classics will be studied; also, scientific texts if desired, and some attention will be given to composition and conversation. Fr. I and II, 8.

PHYSICS.

Prof. Cobleigh.

(1). **General Physics.**—Lectures, recitations and assigned problems three hours per week throughout the year on mechanics, heat, magnetism and electricity. This course is mathematical and technical in its nature, and is particularly designed to meet the needs of students in engineering.

Mathematics (2) is pre-requisite and (3) and (4) must be taken during the same year unless the student has already had these courses in a previous year. Textbook: Hastings and Beach's General Physics.
Soph. I, II, 6.

(2). **Physical Measurements.**—A laboratory course designed to supplement physics (1). It is strictly quantitative, and is given for the purpose of providing laboratory illustrations of fundamental principles of the science and to train the student in making measurements of precision. Textbooks: Mechanics, Molecular Physics and Heat, by Millikan; Laboratory Physics, by Miller. Soph. I, II, 4.

(3). **Electricity and Magnetism.**—Lectures, recitations and problems two hours per week during the first semester of the junior year on the elementary mathematical theory of electricity and magnetism, electrical units and methods of measurements. Physics (1) and (2) are pre-requisite. Textbooks: Electricity and Magnetism, by Gerard.

Jr. Mech. and Elec. I, 2.

(4). **Electrical Measurements.**—A laboratory course supplementing physics (3). It consists of exact measurements of resistance, electromotive force, current, capacity and self-induction, calibration of commercial measuring instruments, insulation tests, battery testing and magnetic measurements, including determinations of the permeability and hysteresis of samples of iron. Five hours per week during the first semester of the junior year are required of electrical engineers, and two and one-half hours are required of mechanical engineers. Jr. Mech. I, 1. Jr. Elec. I, 2.

PHILOSOPHY AND SOCIOLOGY.

President Hamilton.

(5). **Economics.**—This course consists of a study of such questions as land, labor, money, coinage, banking, rent, interest, wages and taxation. The most important questions in economics of the present time are considered. Among these may be mentioned trusts, labor organizations, government ownership of public utilities, co-operation, recent currency legislation and the single tax. Sr. I, II, 4.

PUBLIC SPEAKING.

Mrs. Hall.

(1). Two meetings a week will be devoted to the study of vocal expression. The work will be co-ordinate with that required in English 1; examples of description, narration, exposition and argumentation will be developed in extemporaneous speeches, with special attention to model briefs for debate. A few recitation periods will be devoted to a review of parliamentary law. The second semester will be devoted to voice culture and the study of oratory. Soph. I, II, 2.

TECHNICAL MECHANICS

Prof. Thaler.

(1). **Statics and Dynamics.**—Composition and resolution of forces. Application of the conditions of equilibrium. Determination of motions. Principles of work and energy. Impulse and momentum. Textbook: Mechanics of Engineering, Church. Prequisites, Physics (1) and Calculus. Jr. I, 4.

(2). **Mechanics of Materials.**—Stresses and strains. Elacticity, resilience and strength of materials and compression, tension and torsion. The theory of flexure. Strength and stiffness of beams, cantilevers and long columns. Textbook: Mechanics of Engineering, Church. Prerequisite, Mechanics (1). Jr. II, 4.

SEMINAR.

Engineering Faculty.

(1). Weekly meetings held for the purpose of discussing current engineering literature. Each student will be required to abstract and index engineering periodicals. Jr. and Sr. I, II, 4.

MECHANICAL ENGINEERING.

Prof. Couper.

Assist. Prof. Dearborn.

(11). **Mechanical Drawing.***—The use of drawing instruments and plain lettering; problems in geometric construction to teach accuracy in the use of instruments; isometric and cabinet projections and simple perspective. Fr. I, 3.

(12). **Joinery.**—A graded set of problems is given, with instruction in the proper use and care of carpenter's tools and practice in working to dimensions from blueprints. Fr. I, 2.

(13). **Descriptive Geometry.**—Projections of lines, plane surfaces and solids; intersections. tangents to curves and surfaces; problems in warped surfaces; practical applications of principles to useful problems. Fr. II, 2.

(14). **Foundry and Pattern Making.**—Includes practice in floor and bench molding, core making, and pouring, with lectures on general foundry practice. Also a series of exercises in wood turning and pattern making, and the use of wood-working machinery. Fr. II, 2.

(15). **Kinematics.**—A study of the relative motions of machine parts, including belting, toothed gears, cams and linkages. The class room work is supplemented by a parallel course in drafting. Soph. I, 2.

(15a). **Mechanical Drawing.**—Applications of the principles of kinematics and drawing velocity diagrams, spur and bevel gears and cams. Soph. I, 3.

(16). **Forge Work.**—A graded set of exercises in iron forging, designed to teach the operations of drawing, upsetting, forming and welding, with lectures on the manufacture and properties of iron and steel, standard specifications, etc. Soph. I, 2.

(16a). **Materials of Engineering.**—Lectures on the manufacture and properties of iron and steel, and standard specifications for the various products of the mills Soph. (Civil) I, 1.

(17). **Mechanical Drawing.**—Special applications of the principles of mechanical drawing. Working drawings, tracings and blue printing. Soph. II, 3.

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*Subcourses 1-10 are given by this department in the preparatory course, and are of sub-freshman grade.

(18). **Forge Work.**—A continuation of the work in iron forging, together with the making of steel tools, including tempering, annealing, and case-hardening. Soph. II, 2.

(19). **Mechanical Drawing.**—A continuation of mechanical drawing (17) in which the work will be detail drawings of machine parts preparatory to the work of machine design. Jr. I, 1.

(20). **Machine Work.**—Bench-work, including chipping, filing, fitting, scraping, laying out work from blueprints; with lectures pertaining to the work. Jr. I, 2.

(21). **Machine Design.**—Class room work in the study of machines in regard to size, form and strength. The development and the application of mathematical formulae to the solution of problems in designing of machinery. Jr. II, 3.

(21a). **Mechanical Drawing.**—Applications of the principles of machine design to size, form and strength of machines and machine parts. Jr. II, 3.

(22). **Indicators and Valve Gears.**—A study of the slide valve, both in its simple form and when used in combination with independent cut-off valves, link motions and other reversing gears; automatic cut-off gears, and the Zeuner diagram; principles and operation of the indicator. Jr. II, 2.

(22a). **Mechanical Laboratory.**—Setting of valves with and without the use of the steam engine indicator. Testing of indicator springs and determining the horse power of engines by using the indicator and brake. Jr. II, 1.

(23). **Steam Engines and Boilers.**—A study of the different types and their classification. A description of the various parts and their uses. The care and operation of engines and boilers as regards safety and economy. Jr. II, 2.

(24). **Strength of Materials, Laboratory.**—Each student is required to make a definite series of tests of wrought iron, cast iron, steel and wood in tension, compression, bending and torsion. Jr. II, 1.

(25). **Machine Work.**—Instruction and practice in lathe work, drilling, boring, thread and gear-cutting: with lectures. Jr. II, 2.

(26). **Thermodynamics.**—A thorough course in theory, and its application, especially to steam engines Sr. I, 3.

(26a). **Thermodynamics.**—The laws of thermodynamics as applied to gas engines and refrigerating machinery. Sr. II, 2.

(27). **Boiler Design.**—A study of steam boilers with reference to setting, capacity, strength and construction. Specifications of material to be used and method of handling. Sr. I, 1.

(27a). **Mechanical Drawing.**—A completion of the drawing in machine design and the making of drawings for a steam boiler. Sr. I, 3.

(28). **Mechanical Laboratory.**—Complete tests of power plants, including the efficiencies of boiler and engine; calorimeter tests of the quality of steam. Each student is required to perform all the operations necessary for conducting an accurate test, and to work out the data of an entire test, as well as for individual tests. Sr. I, 3.

(29). **Machine Work.**—Advanced work on lathe, grinder and milling machine; tool making. Sr. I, 2.

(30). **Steam Engine Design.**—The constructive details of some type of automatic cut-off engine will be worked out in the class room, and working drawings thereof made in the drafting room. Sr. II, 2.

(30a). **Mechanical Drawings.**—Designing and drawing of plans for steam engines and steam appliances. Sr. II, 2.

(31). **Contracts and Specifications.**—The various forms of contracts and the value and necessity of contracts drawn up in legal form will be given by some one in the legal profession. The work in specifications will be to examine the common forms in use and write up complete specifications for some engineering project. Sr. II, 1.

(32). **Shop Management.**—Lectures on the organization and arrangement of manufacturing plants; cost accounting, shop methods, duplication of work. Sr. II, 1.

(33). **Thesis.**—Before graduation each student must present a suitable thesis, which shall be the result of original investigation. The suject must be chosen at the beginning of the senior year. Sr. I, II, 3.

ELECTRICAL ENGINEERING.

Prof Thaler.

(1). **Applied Electricity.**—Methods and calculation of wiring, theory of primary cells and storage batteries, electrical measuring instruments and electric light. Jr. I, 3.

(2). **Electrical Laboratory.**—Tracing circuits and wiring, calibrating instruments, efficiency tests of storage batteries, photo-metric tests for finding the efficiency, distribution of light and candle power of incandescent lamps. Jr. I, 2.

(3). **Dynamos and Motors.**—Principles of electro-magnetism, theory of dynamo electrical machines, methods of construction and regulation of dynamos and motors. Jr. II, 4.

(4). **Dynamo and Motor Testing.**—A laboratory course in which students determine the characteristic curves, resistances, inductances, magnetic leakage, and efficiencies of various types of direct-current machines. Jr. II, 2.

(5). **Electrical Diagrams.**—Conventional methods of representing electrical wiring and appliances. Jr. I, 2.

(6) **Dynamo Design.**—Problems in designing electro-magnets, dynamos and motors; complete working drawings and specifications to accompany each design. Jr. II, 3.

(7). **Alternating Currents.**—Theory of alternating currents, properties of alternating current circuits, principles of alternators, transformers, rotary converters, and induction motors. Methods of testing alternating current apparatus. Sr. I and II, 8.

(8). **Alternating Current Testing.**—Laboratory tests to determine self-induction, capacity and mutual induction of alternating current, circuits; regulation and efficiency tests of alternators. transformers, rotary converters and induction motors. Sr. I and II, 4.

(9). **Contracts and Specifications.**—Lectures on contracts by a competent lawyer. Students are required to make specifications for estimates on proposed power plants, transmission lines or electrical apparatus.
Sr. II, 1.

(10). **Electrical Design.**—Problems in designing alternators, transformers and induction motors. Design and specifications of alternating current circuits. Sr. I and II, 6.

(11). **Plant Operation.**—Practice in the operation and care of boilers, engines, dynamos, motors, electric lights and storage batteries of the college power plant. Sr. II, 1.

(12). **Thesis.**—Before graduation each student must present a suitable thesis, which shall be the result of original investigation. The subject must be chosen at the beginning of the senior year. Sr. I and II, 5.

CIVIL ENGINEERING COURSE.

(1). **Plane Surveying.**—The use and adjustment of the ordinary surveying instruments, such as the compass, level and transit. The theory and practice of land surveying and leveling; keeping of field notes and plotting. 2 hours recitation, 4 hours field work and plotting.

(2). **Roads, Streets and Pavements.**—A course in "Good road construction" both for the city and country. Different methods of construction considered, together with the best forms of surface, cost, etc. The influence of good roads upon property values, and the justifiable expense necessary to secure the same. 1 hour per week.

(3). **Topographical and Railroad Surveying..**—Methods and practice in topographical surveying. Reconnoitering, preliminary and location surveys. Theory and practice in laying out railroad curves, turnouts, switches and crossings. Calculation of yardage in embankments and excavation. Cost of railway construction, timber structures and culverts. Making and use of profiles, field maps, cross sections, etc. 3 hours recitation, 4 hours field work and plotting.

(4). **Hydraulics.** Theoretical hydraulics; hydraulic measurements; flow of water through standard orifices, over weirs, through pipes, conduits and canals. 3 hours recitation. Practical use of hydraulic measuring instruments during the semester when conditions will permit.

(5.) **Drainage and Irrigation Engineering.**—This includes the impounding, diverting and conveying water, and its flumes, ditches, methods of measuring the duty of water and its relation to the climate, soils, etc. Drainage of swamp and alkali lands. 3 hours recitation per week. Part of the time of field practice is devoted to this study.

(6). **Sanitary Engineering.**—Collection, distribution and purification of water. Systems of sewerage and water supply. House drainage and sanitary inspection. 3 hours recitation.

(7). **Cement Tests.**—Testing the various natural and hydraulic cements, under the varying conditions and mixtures. 2 hours per week.

(8). **Storage Reservoirs and Dams.**—This course is intended to supplement the course in irrigation. Study of the best methods of impounding water. Design and construction of earth, "rock fill," timber and masonry dams. Engineering design of this semester forms a part of this course. 1 hour recitation, 2 hours reading and 2 hours draughting.

(9). **Field Practice and Engineering Design.**—These periods are devoted to practical work with the various engineering instruments in the field, practical calculations and adjustment of instruments during inclement weather. 2 hours each afternoon in this work.

(10). **Geodetic Surveying.**—Elements of geodesy; base line measurements, triangulation, determination of true meridian and latitude. 4 hours field work per week.

(11). **Water Power Development.**—A course in the development of water powers. The use of the turbine, impulse and other forms of water wheels. The design and construction of headraces, spillways, etc. The class will not only be required to examine powers and design their development, but to become familiar with the manner and forms of making engineering reports upon same. 2 hours recitation, 2 hours reading per week.

(12). **Foundations and Masonry.** This course includes a study of materials and methods employed in the construction of piers, abutments and retaining walls; economy of construction, strength of joined material, composition of different kinds of mortar. 2 hours recitation per week.

(13). **Hydrographic Surveying.**—This branch of surveying embraces the methods of surveying bodies of water; determining the contour of bottom of harbors, or sheets of water; the depth of soundings; the position of channels and shoals. 2 hours recitation per week.

(14). **Contracts and Specifications.**—The elementary law of contracts and its application to engineering contracts considered, together with the correct form for specifications and the judicial interpretation placed on the technical terms commonly found in engineering specifications. 2 hours recitation per week.

(15). **Cost of Construction.**—This course is designed to acquaint the student with the cost of labor and materials used in engineering construction; cost of installations, surveys, examinations and reports in engineering work. 2 hours recitation and lecture per week.

(16). **Practical Astronomy.**—A short course in astronomy designed especially for the civil engineering students. 2 hours recitation per week.

(17). **Roofs and Bridges**—Theory and calculation of stresses in roof and bridge trusses. Analytical and graphical methods employed. 2 hours recitation, 4 hours draughting.

COLLEGE PUBLICATIONS.

The college issues the following publications any or all of which will be sent to any address upon application as soon as issued. Address J. M. Hamilton, President, Bozeman, Montana.

General Information.—Including a full account of the organization of the college, a description of its buildings and equipment, a full statement of fees, and a list of students.

General Science.—The work in general science arranged according to the group system leads to the degree of B. S. The student selects one of the groups of studies arranged about each of the following subjects: Botany, Chemistry, Domestic Science, Mathematics, Modern Languages, History, English, Physics, and Zoology

Agriculture.—A full outline of the college course in agriculture, leading to the degree of Bachelor of Scientific Agriculture, with an account of the studies purseued.

Engineering.—An outline of the courses in mechanical, electrical and civil engineering, leading respectively to the degrees of Bachelor of Mechanical, Electrical and Civil Engineering, with an account of the subjects studied in each course.

Preparatory Department.—Outlines of the preparatory courses, Academic, Agriculture, and Manual Training, any one of which prepares for any of the college courses.

Business.—An outline of work in bookkeeping, business practice, stenography and typewriting with related work in English, penmanship, commercial law and other branches.

Art.—An outline of the work in art, providing a course of four years, more or less, with a description of methods and equipment.

Domestic Science.—An account of all the work offered in domestic science, both in the one year and four year courses.

Music.—A full account of the work offered in the piano department and in the vocal department, with a statement of the fees. The tuition in these departments is charged separately.

Winter Courses.—An account of winter courses in agriculture and engineering, which will begin November 14 and end March 29. These courses have no requirements for entrance, the fees are smaller than for the other courses and the work intended to be immediately practical. This bulletin will be issued in September, 1905.

Bulletin of THE MONTANA STATE COLLEGE *of* AGRICULTURE *and* MECHANIC ARTS.

FOUNDED EIGHTEEN HUNDRED NINETY-THREE

Volume 3. ***Number*** *6*

Preparatory Courses.

Published Monthly by the College
During the College Year. . . .
MARCH 1, 1906

Entered April 14, 1904, at Bozeman. Montana, as Second Class Matter Under Act of Congress of July 16, 1894.

FACULTY IN PREPARATORY COURSE.

JAMES M. HAMILTON, M. S., (Union Christian College), President.

MISS MARY A. CANTWELL,
Principal of the Preparatory Department.

MRS. F. E. MARSHALL,
Professor of Art.

AARON H. CURRIER, A. M., (Oberlin College),
Professor of French and German.

MISS LILLA A. HARKINS, M. S., (South Dakota Agri. Col.),
Professor of Domestic Science.

WILLIAM D. TALLMAN, B. S., (University of Wisconsin),
Professor of Mathematics.

WILLIAM M. COBLEIGH, A. M., (Columbia University),
Professor of Physics.

GEORGE B. COUPER, M. E., (University of Minnesota),
Professor of Mechanical Engineering.

CHARLES S. DEARBORN, B. S., (Kansas Agri. Col.),
Assistant Professor of Mechanical Engineering in Charge of Shops.

MISS HELEN R. BREWER, A. B., (Iowa College),
Instructor in Latin and History.

MRS. MABEL KINNEY HALL, Ph. B., (Oberlin College),
Instructor in Preparatory Department.

MISS FLORENCE BALLINGER,
Instructor in Sewing.

WYATT W. JONES, S. B., (Harvard University),
Instructor in Botany and Zoology.

PREPARATORY DEPARTMENT.

MISS M. A. CANTWELL, Principal.
MRS. MABEL K. HALL, Instructor.

PREPARATORY COURSE.

This department of instruction covers three years, being thus placed on a level with the accredited high schools of the state. The instructional force includes, in addition to those mentioned above, many members of the college faculty, who give preparatory instruction in their special subjects.

Three courses are provided—the Academic, the Manual Training and the Domestic Economy. These differ in a small part of the work of the second and third years. The academic course requires Latin or German for the last two years; while the other two substitute for the language the special subjects Manual Training and Domestic Economy, respectively. Students who undertake the academic course must carry the language for two years to receive credit. Any one of these courses prepares for any one of the college courses. They furnish a fair knowledge to those whose circumstances will not allow them to take a regular college course and are also helpful to those qualifying themselves to teach.

For entrance the student must be at least thirteen years of age, and shall have finished the requisite work for admission to the ninth grade of high school work.

Applicants will be required to pass an examination, or otherwise satisfy the faculty of their proficiency before entering any classes.

It is highly important that students should enter at the opening of the year, as much of the year's work is based upon the principles laid down at the beginning. Bring your textbooks, as they will be of much assistance for reference.

Military drill will be required of men throughout the course, and physical culture of women in the first two years.

Regular graduating exercises are held in this department and students who satisfactorily complete the preparatory course will be given suitable diplomas.

A liberal course of reading is given for each year, and students are requested to cover the course as a part of their required work. It is also desirable that, as far as possible, students purchase these books, thus making them a part of their own library.

Beginning with the year 1904-5 an annual prize of ten dollars for excellence in declamation has been offered for regular students in the preparatory department by Judge F. K. Armstrong of Bozeman.

PREPARATORY COURSES.

First Year.

First Semester		Second Semester	
English Composition	5	English Composition	5
Arithmetic	5	Algebra	5
Greek History	3	Roman History	3
Drawing	1	Drawing	1
Wood Joinery (men)	2	Wood Turning (Men)	2
Sewing (women)	2	Sewing (Women)	2
Military Drill (men)	1	Military Drill(Men)	1
Physical Culture (Women)	1	Physical Culture (Women)	1

Second Year

Rhetoric	4	Rhetoric	4
Algebra	4	Algebra	4
Mediaeval History	3	Modern History	3
Biology	3	Biology	3
Military Drill (men)	1	Military Drill (Men)	1
Physical Culture (Women)	1	Physical Culture (Women)	1
Elect one of the following:		Elect one of the following:	
German or Latin	4	German or Latin	4
Garment Making (Women	4	Cooking (Women)	4
Mechanical Drawing (Men)	2	Mechanical Drawing (Men)	2
Forging (Men)	2	Forging (Men)	2

Third Year

English Literature	4	English Literature	4
Plane Geometry	5	Solid Geometry	5
Physics	3	Physics	3
Drawing	2	Drawing	2
Military Drill (Men)	1	Military Drill (Men)	1
Cooking (Women)	1	Cooking (Women)	1
Elect one of the following:		Elect one of the following:	
German or Latin	4	German or Latin	4
Bills of Fare and Cooking Demonstrations (Women)	4	Dressmaking (Women)	4
Mechanical Drawing (Men)	2	Mechanical Drawing (Men)	2
Cabinet Making or Metal Working (Men)	2	Cabinet Making or Metal Working (Men)	2

DESCRIPTION OF THE WORK.

English.—The work in English includes (1) English composition (2) rhetoric, (3) American literature, (4) English literature.

(1) and (2). **English Composition and Rhetoric.**—The aim of the course in English comopsition and rhetoric is to secure accurate and graceful expression, and to afford constant exercise in composition work. In connection with this work a classic will be made the subject of class room study, thus forming a basis for the study of American literature. During the first and second semester of the course in Rhetoric one hour a week will be devoted to elocution.

(3) **English, (4) American Literature.**—The object of this course is to develope an intelligent appreciation of American and English masterpieces, and to promote a love for standard literature. Several American and English classics will be made the subject of critical class room study. The student will find in the library valuable works for reference.

General History.—The work in history will follow as far as practicable the line suggested for high school work by the State Board of Education. The object of the courses will be an acquaintance with the epochs of history. One year will be devoted to Greece and Rome and one year to mediaeval and modern history. A text book will be used, supplemented by library reference when necessary.

Latin.—(a) In the first year's work the aim is to secure a ready knowledge of the inflectional forms, the main rules of syntax, and a vocabulary which will prepare for easy Latin reading. For this purpose Collar and Daniell's First Latin Book is used, which in connection with grammatical study gives reading lessons adapted to the ability of the learner. (b). Drill similar to that of the first year is continued in this course in connection with the reading of easy selections from classic authors—such as are found in Rolfe and Dennison's Junior Latin Book. The aim is to enable the student to read the simpler classics readily.

German.—In accordance with the present college entrance requirements in Montana, two years of German are offered in the preparatory courses as a substitute for Latin. The work of the first year is of the usual elementary nature, including study of grammar, composition, pronunciation, careful reading of easy texts and sight reading. The second year's work is also largely practical, but affords as well an introduction to classic German literature. The required reading during the two years is not less than 600 pages.

Mathematics.—Under this subject is included a semester's review of arithmetic, three semesters of algebra, and one semester each of plane and solid geometry.

Elementary Physics.—Lectures with experimental illustrations, recitations, assigned problems and laboratory work five hours per week throughout the year in mechanics, sound, heat, light, electricity and magnetism. Textbooks: High School Physics, by Carhart and Chute, and Laboratory Notes, by Cobleigh.

Biology.—This course will be conducted in such a manner as to give the pupils a good understanding of the first principles of the science of living things. While the subject matter of the course will be taken from the field of zoology and botany, it is not the purpose to train up zoologists and botanists, but to equip the pupils by the information and training given to observe and interpret simple biological facts. Recitations and laboratory exercises three times per week.

Drawing.—Free hand drawing from geometric solids and casts. Study of light and shade. Clay modeling. Object drawing. Study of plant forms, with suggestions for their application to design. Memory and time drawing. Blackboard work frequently.

Sewing.—This subject is required of all girls during both semesters of the first year. The work is chiefly plain sewing, with some practice in garment making. Each student furnishes her own materials, as the garments made form a part of her own wardrobe. Students passing a satisfactory examination in sewing will be excused.

Wood Joinery.—This work will consist of bench work in wood with instruction in the use and care of the ordinary carpenter's tools and practice in working from blue prints.

Wood Turning.—This comprises work on the lathe in turning useful and ornamental objects such as chisel handles, table legs, vases, rings, etc.

ELECTIVE WORK IN MANUAL TRAINING.

A student taking the regular engineering course, after completing the manual training work, will be required to do more advanced work than those who have not completed this work.

Forging.—This work will include forging and welding of iron and the making and tempering of some steel tools such as chisels and punches.

Cabinet Making.—This will comprise the making of tables, desks, bookcases, and other furniture.

Metal Working.—The courses in metal working will consist of advanced forging and bench work in metals, hand fitting and finishing. The student will choose between cabinet making and metal working.

Mechanical Drawing.—The student is first given work in free hand and mechanical lettering. The remainder of the year is given up to freehand sketching of objects with a few plates of mechanical drawings made from the sketches. The second year's work will include detail drawings, cabinet and isometric projections and shading.

ELECTIVE WORK IN DOMESTIC SCIENCE.

Garmentmaking.—In this course at least five garments and two shirt waists must be completed.

Dressmaking.—In this course the McDowell system of dresscutting is taught. In this course and the preceding, the girls furnish their own materials and the completed work is their own. Many girls are enabled by taking this course to do all their own sewing.

Cooking.—This work may be elected in the second semester of the second year and the first semester of the third year. The course will include both lectures and practice.

COLLEGE PUBLICATIONS.

The college issues the following publications any or all of which will be sent to any address upon application as soon as issued. Address J. M. Hamilton, President, Bozeman, Montana.

General Information.—Including a full account of the organization of the college, a description of its buildings and equipment, a full statement of fees, and a list of students.

General Science.—The work in general science arranged according to the group system leads to the degree of B. S. The student selects one of the groups of studies arranged about each of the following subjects: Biology, Chemistry, Domestic Science, Mathematics and Physics, History, and Literature.

Agriculture.—A full outline of the college course in agriculture, leading to the degree of Bachelor of Scientific Agriculture, with an account of the studies pursued.

Engineering.—An outline of the courses in mechanical, electrical and civil engineering, leading respectively to the degrees of Bachelor of Mechanical, Electrical and Civil Engineering, with an account of the subjects studied in each course.

Preparatory Department.—Outlines of the preparatory courses, Academic, Domestic Economy and Manual Training, any one of which prepares for any of the college courses.

Business.—An outline of work in bookkeeping, business practice, stenography and typewriting with related work in English, penmanship, commercial law and other branches.

Art.—An outline of the work in art, providing a course of four years, more or less, with a description of methods and equipment.

Domestic Science.—An account of all the work offered in domestic science, both in one year, preparatory, and four year courses.

Music.—A full account of the work offered in the piano department, the violin department and in the vocal department, with statement of the fees. The tuition in these departments is charged separately.

Winter Courses.—An account of winter courses in agriculture and engineering, which will begin November 13 and end March 29. These courses have no requirements for entrance, the fees are smaller than for the other courses and the work is intended to be immediately practical. This bulletin will be issued in September, 1906.

Bulletin of THE MONTANA STATE
COLLEGE *of* AGRICULTURE *and*
MECHANIC ARTS.

FOUNDED EIGHTEEN HUNDRED NINETY-THREE

Volume 3. *Number 7*

Course in Art for Men and Women.

Published Monthly by the College
During the College Year. . . .
APRIL 1, 1906

Entered April 14, 1904, at Bozeman. Montana, as Second Class Matter Under Act of
Congress of July 16, 1894.

THE WORK IN ART.

This work is intended to familiarize the student with the principles that underlie art, as well as with the practice of the various forms of art chosen according to the taste or talent of the student. Though lectures are given on the principles and history of art, the teaching is entirely individual. Among the forms of work offered are drawing, with attention to grouping, light and shade, perspective; clay modeling, wood carving, decorative designing, china painting, art embroidery; painting in oil or water colors, sketching from nature, figure study.

That the study of drawing is important in education is now universally acknowledged. Aside from advantage to engineers, machinists and architects, of a practical knowledge of draughtsmanship, the pyschologic value of a knowledge of drawing is very great. The chief object of education is the quickening of the powers of the mind. Drawing brings out the power of analysis, habits of observation, qualities of judgment, imagination, memory and taste. It is something more than mere training of the eye. To achieve even moderate success requires that thought be put into every line. A line put down without thought is always a wrong line.

The student is taught first to construct useful form—strong, fit for the purpose; then ornamental. He is taught designing for flat surfaces as for fabrics, and then the construction of a form, such as a cup, or vase, or a building. Next he learns the art of composition or the grouping of things in the right relations and right proportions.

Art, aside from anything we can produce, helps us to appreciate the works of great artists and opens our eyes to the beauty of form and color in nature. It extends our powers of enjoyment and gives us a better understanding of the history of the human spirit. It gives us a proper gratitude for the work of great artists.

OUTLINE OF ART COURSE.

The Art Course, as here outlined, will indicate the work of the average student in a four years' course, for those who attend mainly for the art work. All the teaching being individual, the student is carried forward just as rapidly as his own talent and industry will permit.

Every effort is made to teach correct drawing. The pupil is then encouraged to apply such knowledge in any direction in which his talents may seem to lie, and is allowed the use of various mediums, such as oil, water color, pastel, etc., and also can take lessons in china painting. The classes in drawing and wood carving are open to students in any of the college courses.

FRESHMAN YEAR.

Drawing from the cast, in charcoal or crayon. Still life and object drawing. Drawing from plants and other natural forms in preparation for design. Sketching from nature, in the last few weeks of the second semester. In object drawing the pupil is required to study artistic grouping and good arrangement of light and shade. Memory and time drawing and blacboard work will be carried through the year.

Perspective, and its practical application to the drawing of buildings and to sketching from nature. Perspective problems to be worked out and carefully drawn. Water color tinting for mechanical work. Two art lectures a week. Clay modeling and wood carving may be studied at the discretion of the teacher.

SOPHOMORE YEAR.

General principles of Design.—Color schemes and color harmony. Historic ornament. Each student will occasionally be required to submit original designs for embroidery, wood carving and other decorative work, based upon plant forms which he has drawn during previous years.

Painting of plants and still life in oil or water color. Pen and ink drawing. Sketching from nature as the weather will permit.

JUNIOR YEAR.

Wood Carving.—An extended course in carving as applied to furniture and other objects. Lecture on the history of wood carving.

Figure Study.—In this year there is a life class, open to all who show talent for figure drawing. Study of costume. Painting in oil and water color. Lessons on decoration of interiors.

SENIOR YEAR.

Any branch of art preferred by the student. Otherwise further instruction in branches already begun by the student. China painting if desired.

GENERAL INFORMATION.

The Art Department has a good equipment of casts in busts, masks, parts of the human figure, ornament and geometric solids; benches and tools for wood carving and clay modeling, a kiln for firing china, a perforating machine for transferring designs for embroidery, and photographic copies of sculptures and world pictures. There is also a splendid selection of books on art.

Work for Exhibition.—It is required that students who have done work suitable for exhibition purposes shall place such work at the disposal of the institution for a period of two years.

Normal Work.—Those who are preparing for teaching in the public schools are given special training in the lines required and are given practice in actual teaching under the direction of the head of the department.

Electives in Other Subjects.—Students who are registered in the Art Course are admitted without further tuition fees to such other work of the college as their preparation will permit them to pursue to advantage. Attention is called in this connection to the work offered in history, literature, language, domestic science, music, (which is charged separately) and in engineering and mechanic arts.

Work in Art Open to All.—The work in the art department is not limited to the students specially registered in that department. Students in most of the college courses are required to take a prescribed amount of this work and in most of the courses some work in art may be selected and counted toward a degree.

Bulletin of THE MONTANA STATE COLLEGE *of* AGRICULTURE *and* MECHANIC ARTS.

FOUNDED EIGHTEEN HUNDRED NINETY-THREE

UNIVERSITY OF ILLINOIS
PRESIDENT'S OFFICE

Volume 3. *Number 8*

Courses in Domestic Science.

Published Monthly by the College
During the College Year. . . .
MAY 1, 1906

Entered April 14, 1904, at Bozeman. Montana, as Second Class Matter Under Act of Congress of July 16, 1894.

THE WORK IN DOMESTIC SCIENCE.

MISS LILLA A. HARKINS, M. S., (South Dakota Agri. Col.),
Professor of Domestic Science.
MISS FLORENCE BALLINGER.
Instructor in Sewing.

The Department of Domestic Science offers two courses in this subject, which are outlined below. The four year course is on a par with the other regular degree courses and leads to the degree of B. S. It permits an alternation in the Freshman year between a part of the mathematics, and sewing and cooking; and permits the omission of either physics or biology in the sophomore and junior years in favor of more work in history and language. It is the purpose of this course to give women a liberal education with a scientific basis.

It is also designed to provide an opportunity for the correlation of chemistry and biology with household work. Normal training, both in sewing and cooking, is given to those students who are preparing to become domestic science teachers. The work of the department aims to be scientific, artistic and practical.

The one year course, which follows the four year course in this bulletin is intended for those who wish systematic work in household economy and who cannot take the time for a four year course. The work is necessarily much more elementary than in the longer course and no degree is given. A diploma, crediting the students with one year's work, is given upon the satisfactory completion of the course.

FOUR YEAR COURSE IN DOMESTIC SCIENCE.

Outline ***

Freshman Year.—Mathematics (2), 2; Mathematics (1 and 3), 7, or Sewing (7a) 5, and Cooking (2), 1; Chemistry (1 and 2), 8; English (1), 4; Public Speaking, 2; Foreign Language*, 8; Art (1, 2, 3, 4, or 5), 2; Domestic Science (1), 2.

Sophomore Year. Foreign language*, 6; English (10), 4; History (1), 4; Biology (1a and 9), 10, or Biology (3), 4, and Cooking (2), 2, and Sewing (9), 1; Domestic Science, (2 and 3), 4; Art (1, 2, 3, 4, or 5), 2; Sewing (7 and 9), 4; Elective**, 4 to 7.

Junior Year. English (2, 3, or 11), 4; History (2), 4; Biology (7 and 12), 6; Economics (3), 4; Chemistry (15), 8; Domestic Science (4 and 5), 4; Sewing (8), 2; Elective**, 6.

Senior Year. Psychology (1), 3; Ethics (2), 3; English (2, 3, or 11), or Foreign Language *, 4; Domestic Science, (6a and 5a), 6; Sewing (9 and 10), 4; Biology or Chemistry, and Thesis, 8; Elective**, 10.

DESCRIPTION OF WORK IN DOMESTIC SCIENCE.

(1) **General Cookery.** This course is required of all freshman girls. The object of this work is to familiarize the students with the most sys-systematic, economical, healthful and attractive methods of preparing foods. Special attention is given to table decorations and serving of meals. Students who studied cooking in the preparatory course are given work in planning bills of fare and cooking demonstrations. Miss Harkins.

(2) **Selection and Preparation of Food and Cooking Demonstrations.** The principles of diet and the relation of food to health are studied. Standard dietaries are examined and bills of fare planned. Each student gives two public demonstrations. Miss Harkins.

(3) **Economy of Food.** Special attention is given to the economic side of the food question. Bills of fare are planned and carried out. The government bulletins are read, and the text book is Richard's Cost of Living. Miss Harkins.

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* Latin, German or French.

** Under this heading are included music, and other subjects described in the General Science Bulletin.

*** In this outline the figures in the parenthesis refer to the paragraphs below where the work is described. The other numerals indicate the number of credits allowed for each subject. A credit is one hour a week for a semester, of recitation or lecture work, or two hours a week for a semester of library work or drawing.

(4) **Home Architecture and Sanitation.** The surroundings, situation and plan of the house, heating, lighting, plumbing and drainage.
Miss Harkins.

(5) **Home Nursing and Invalid Cookery.** Miss Harkins.

(5a) **Final Demonstration.** Each graduate prepares a breakfast or a luncheon for a public demonstration. Miss Harkins.

(6). **Journal Meetings.** Topics relating to domestic science will be assigned and discussed. Articles in magazines will be reviewed.
Miss Harkins.

(7a) **Sewing.** Sample book, plain sewing and machine sewing, garment-making. Miss Ballinger.

(7) **Sewing.** This work is required of all sophomore girls. The work is carefully graded to the capability of the student. At least three plain garments, a shirt waist and an unlined dress must be completed.
MissBallinger.

(8). **Sewing.** Drafting, cutting and fitting and plain dress making.
Miss Ballinger.

(9). **Sewing.** General dress making. Miss Ballinger.

(10). **Sewing.** Art needlework. During the second semester the graduating dress will be made. Miss Ballinger.

(11). **Thesis.** In the beginning of the senior year the student selects her subject for graduating thesis. This must be along the line of domestic science or the application of chemistry or biology to domestic science.
Miss Harkins.

OTHER SUBJECTS NAMED IN THE OUTLINE.*

(1) **Psychology.** This course presents a general view of modern psychology and is required of all general science students. It gives a practical exposition of the materials and methods of psychological investigation. The lectures are accompanied by class demonstrations. Attention is given to such topics as the growth of the central nervous system, the nature of consciousness, sensory and motory training ,the higher intellectual faculties and the will. I, 3. President Hamilton.

(2). **Ethics** The work in ethics includes a study of the evolution of conduct, moral standards, the social and industrial life, the development and trend of ethical thought and an examination of utilitarianism. Required of general science students. II, 3. President Hamilton.

(3). **Economics.** This course consists of a study of such questions as land, capital, labor, money, coinage, banking, rent, interest, wages and taxation. The most important questions in economics of the present time are considered. Among these may be mentioned trusts, labor organizations, government ownership of public utilities, co-operation, recent currency legislation and the single tax. Required of general science students. I and II, 4. President Hamilton.

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*The Roman Numerals I and II in the following outline designate the first and second semesters respectively.

(1a). Invertebrate Zoology. Devoted to a study of the invertebrate animals, including their morphology, development, habits, economic or popular interest and classification. The broad biological principles are brought out and emphasized. The class room work is based on Weysse's "Synoptic Text Book of Zoology." The laboratory exercises include a study of the morphology of types, reference reading and practical work in the classification of animals. Required of agricultural students and general science students except those in the mathematics and physics group. Class room exercises by Prof. Cooley. Laboratory work directed by Mr. Jones. I, 5.

(3). Animal Physiology and Histology. The student is required to prepare for microscopical study a series of tissues taken from the bodies of freshly killed animals and these slides, together with a large series owned by the department, form the basis of an extended study of animal tissues. By a series of lectures, supplemented by reading courses, the student is taught the main facts of animal physiology. Required of agricultural and biology group students. Elective for general science and domestic science students. I, 4. Prof. Cooley.

(7). Household Economic Entomology. Lectures on insect life injurious to food materials, clothing, carpets, draperies, etc. Required of college students in domestic science. Open to other lady students in the general science courses. Two lectures per week. I, 2. Prof. Cooley.

(9). General Botany. Anatomy, morphology and classification of the higher plants. Flower analysis and the making of a small herbarium. Required of all agricultural and general science students. Two lectures and three laboratory exercises per week. II, 5. Mr. Jones.

(12). Bacteriology. An elementary study of the life history of bacteria, their growth in nutrient media and methods of analysis and classification. The part they play in agriculture, medicine and our daily life is discussed. Required of agriculture and domestic science students. Elective to others so far as the limited space and equipment will allow. II, 4.

Mr ....

(1). General Inorganic Chemistry. Lectures with frequent recitations are given on the general principles of chemistry. The properties, preparation and applications of the elements and their principal compounds are studied.

The first semester will be given to the study of the non-metals and the second semester to the metals. Throughout the year lecture experiments will be performed, illustrating general principles and quantitative relationships. Fr. 1—II, 4. Mr. Burke.

(2). Laboratory Experiments. Accompanying course (1) is this laboratory course which comprises the preparation, physical and chemical properties, and the tests of the principal elements and inorganic compounds. Qualitative analysis and some quantitative experiments are also included.

The first semester will be taken up with the study of the elements, compounds, and quantitative experiments and the second semester with the study of qualitative analysis. Fr. I, II, 4. Mr. Burke.

(15). Chemistry of Foods. A laboratory and lecture course designed especially for students in the junior year of the Domestic Science course. I and II, 8. Prof. Chesnut and Mr. Burke.

(1). English Composition. This course is required of all freshmen. The course is almost altogether practice in various types of prose composition—narration ,description, exposition, criticism and argumentation. The class meets ordinarily once a week. The instructor from time to time meets each student for private conference about his work. I and II, 4. Prof. Brewer.

(2). This is a course in expository writing for those students who are specializing in other subjects. Papers not extremely technical, prepared for work in other courses may also be handed in as part of the work of this course. The teaching will be altogether individual. I and II, 4. Prof. Brewer.

(3). This is an advanced course for those who wish to study composition as a fine art. It will include a study of the historical development of English prose style and such other work as may suit the taste or needs of those who edect the course. I and II, 4. Prof. Brewer.

(10). English Literature. A reading course from Chaucer to the present day. A large amount of reading will be required and more recommended. Written reports are required frequently. A part of the class room time will be given to critical reading of English masterpieces. This course is required of all candidates for the bachelor's degree in science. I and II, 4. Prof. Brewer.

(11). This course in English literature is varied each year, so that it may be elected two years in succession. The course will be a detailed study of some limited period of English literature or the history of some special form. Prof. Brewer.

(1). European History. It is taken for granted that the student has had a preparatory course in general history with some such text as Myers or West. In this course special attention will be paid to the development of one or two European States. I and II, 4. Miss Brewer.

(2). Medieval History. The student is expected to have had courses which have given him knowledge of the great epochs in history and their relations to each other. Therefore, in this course he will take up the thorough study of one period. He will be encouraged to form his own opinions by the use of such historical sources of this period as are available in transalations. In this connection the student will be given practice in application of the fundamental principles used in testing the value of historical material. I and II, 4. Miss Brewer.

(1). Cicero. The four orations against Catiline are read, and two

others. Roman politics, as compared with those of our day, always interest students who have an intelligent interest in current events, and there is every opportunity for such comparative study in this work. I and II, 8.
Miss Brewer.

(2) **Virgil.** The first six books of the Aeneid are read. Metrical reading of the Latin is required constantly. The students are encouraged to make metrical translations and paraphrases. I and II, 8. Prof. Brewer.

(3). **Livy and Horace.** The special aim in this year's work, as in the previous course, is to enable the student to acquire facility in reading and to instruct him in the use of Latin texts as a means of acquiring knowledge of the public and private life of the Romans; but grammatical study and literary criticism will not be neglected. I and II, 4.
Miss Brewer.

(1). **Algebra.** Beginning with a review of radicals and quadratic equations, the course includes progressions, arrangements and group, binominal theorem, theory of limits, undetermined coefficients, logarithms, and an introduction to the theory of equations. I, 3. Prof. Tallman.

(2). **Plane Trigonometry.** I, 2. Prof. Tallman.

(3). **Analytical Geometry.** Straight line and conic sections, with an introduction to the geometry of three dimensions. II, 4. Prof. Tallman.

(1a). **General Descriptive Physics.** Two lectures and laboratory work two hours per week in mechanics, sound, heat, light, electricity and magnetism. This course is arranged to suit the needs of students in the course in agriculture and students in the chemical, biological and other general science groups who do not elect course (1 and 2). Mathematics (2) is prerequisite. Text books: Physics, by Mann & Twiss; Laboratory Course, by Sabine; Laboratory Physics, by Miller. I and II, 6.
Prof. Cobleigh.

Public Speaking. Two meetings a week will be devoted to the study of vocal expression. The work will be co-ordinate with that required in English (1); examples of description, narration, exposition and argumentation will be developed in extemporaneous speeches, with special attention to model briefs for debate. A few recitation periods will be devoted to a review of parliamentary law. The second semester will be devoted to voice culture and the study of oratory. I and II, 2.
Mrs. Hall.

ONE YEAR COURSE IN HOUSEHOLD ECONOMY.

Outline*

First Semester. Lectures on Household Economics, 4; Cooking, 6; Sewing, 10; Art, 4; Elective: History, Language, Science or Music, 3.

Second Semester. Sanitation, 3; Cooking, 6; Sewing, 12; Art, 4; Elective, Dairying, 7; or Music, Language, or History.

DESCRIPTION OF WORK.

Sewing. During the first semester six garments must be completed. During the second semester four shirt waists, a coat suit, or lined dress, and the graduating dress must be completed. The Darling system of cutting and fitting is taught.

Cooking. This work is both theoretical and practical. During the second semester each student gives one demonstration. Much attention is given to serving meals. For final examination each student prepares two three-course luncheons.

Dairying. The elaboration, composition, properties, and fermentations of milk. The methods used in testing, buying and preserving milk for food, or for manufacturing purposes. The manufacturing of butter and cheese, with explanations of the defects in much of the butter and cheese used for domestic purposes, and how these defects may be detected and overcome. Students who desire may take practical work in the College Dairy along with the special dairy students, in both butter and cheese making.

Drawing. Free hand drawing from geometric solids and casts. Study of light and shade. Clay modeling. Object drawing. Study of plant forms, with suggestions for their application to design. Memory and time drawing. Blackboard work frequently.

Household Economy. House construction and material, furnishings, management, and care of all parts of the house. The textbook used is Miss Parloa's Home Economics. Lectures on marketing are also given, including such subjects as methods of buying, home and foreign products, care of supplies, food adulteration. This course also includes work in practical household arts, as cleaning, sweeping, cleaning paint, windows and metals, care of dining room, duties of hostess and waitress, table etiquette, planning bills of fare, and calculation of cost of the various dishes made in the cooking class. Five papers must be handed in during the semester on some subject pertaining to home economics. Once a week each student reports on some magazine article that she considers important. The library is well supplied with books and magazines for this department.

Sanitation. The house site, surroundings, cellar, ventilation, lighting, heating, plumbing, drainage, water-supply, disposal of refuse, general care of the house. Five papers must be handed in during the semester.

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*In this table the figures refer to the total number of hours in the class room.

Bulletin of THE MONTANA STATE COLLEGE *of* AGRICULTURE *and* MECHANIC ARTS.

FOUNDED EIGHTEEN HUNDRED NINETY-THREE

Volume 3. *Number* 1

Winter Courses in Agriculture and Engineering

Nov. 14, 1905—March 30, 1906

Published Monthly by the College
During the College Year. . . . .
OCTOBER 1, 1905

Entered April 14, 1904, at Bozeman. Montana, as Second Class Matter, Under Act of Congress of July 16, 1894.

WINTER COURSE IN AGRICULTURE.

JAMES M. HAMILTON, M. S. (Union Christian Col.),
President.

ROBERT A. COOLEY, B. S. (Mass. Agr. Col.),
Professor of Zoology and Entomology.

FREDERICK B. LINFIELD, B. S. A. (Ontario Agr. Col.),
Professor of Animal Husbandry.

WILLIAM J. ELLIOTT, B. S. A. (Ontario Agr. Col.),
Professor of Dairying and Assistant in Animal Husbandry.

ALFRED ATKINSON, B. S. A. (Iowa State Col.),
Professor of Agronomy.

E. TAPPAN TANNATT, B. S. (Wash. State Col.),
Professor of Civil Engineering.

ROY W. FISHER, B. S. (Univ. of Idaho),
Assistant Professor of Horticulture.

H. C. GARDINER, M. D. C., (Chi. Vet. Col.),
Instructor in Veterinary Science.

This course begins on November 14, 1905, and closes March 30, 1906. It is designed to meet the wants of those who wish to make a more practical study of agriculture and who cannot remain throughout the entire year.

The work has been planned to give the largest amount of information and assistance possible. The subjects taught are those of which every farmer should have a full and clear knowledge, and are presented in a manner to make the information helpful in the highest degree.

As far as possible, the instruction given will be supplemented by practical work in the laboratories, in the college dairy, and in the greenhouse and orchard. Visits will also be made to the farms, herds and other points of interest in the neighborhood of the college.

No preparatory test will be required; but those taking this course must be over seventeen years of age. A general fee of $4.00 per year will be charged, and a laboratory fee of $2.00 for dairying and soil physics. For shop work, see engineering course.

OUTLINE OF WINTER COURSE IN AGRICULTURE.

FIRST YEAR.

First Term.		Second Term.	
Fruit Growing	3	Horticultural Methods	4
Crop Production	3	Soil Physics	4
Animal Types	3	Dairying (3) and (6)	3
Entomology	2	Breeds of Live Stock	3
Dairying (1), (2) and (4)	3	Bee Culture	2
Arithmetic or composition	3	Arithmetic or composition	3

Laboratory.

Farm Crops	2	Stock Judging	4
Animal Types	4	Dairying	6
Dairy Laboratory	6	Veterinary Science	2

SECOND YEAR

First Term.		Second Term.	
Livestock Feeding and Management	5	Principles of Breeding	3
Veterinary Science	5	Soil Fertility	3
Irrigation	3	Landscape and Vegetable Garden'g	3
Farm Crops	2	Business Forms	3
Arithmetic or composition	3	Arithmetic or composition	3
Dairying (5) and (7)	3	Forestry	2

Laboratory.

Farm Crops	4	Soil Fertility	2
Carpentry and Dairying	6	Forge Work or Dairy	6
		Steam Engineering	4

ANIMAL INDUSTRY.

Animal Types—Or a study of types as related to production or work. Three types of cattle will be studied, the dairy, beef, and dual purpose; the market classes of horses, the bacon and lard types of hogs, and the mutton and wool types of sheep.

Breeds of Live Stock—This is a study of the different breeds of live stock, of the forces which have produced them, and of their adaptability to various conditions and management.

Live Stock Feeding and Management—A study will be made of the principles underlying the successful feeding of animals on the farm and the application of the same to the practical conditions of Montana.

Principles of Breeding—This course includes a study of the laws of heredity, correlation, reversion, variation, fecundity, methods of breeding, cross-breeding, selection, etc.

Veterinary Science—The work in veterinary science will consist principally of a study of the different diseases most commonly affecting farm stock, with special reference to diagnosis and treatment.

DAIRYING.

(1) **Dairy Farming**—The place and advantages of the dairy on the Montana farm.

(2) **Milk**—Its elaboration, composition and fermentation. Its use as a food, and methods of handling.

(3) **Milk Testing**—The use of the Babcock test and other instruments in determining the value of milk for food or manufacturing purposes and for detecting adulterations.

(4) **Butter Making**—Creamery and dairy methods are fully discussed. In the thoroughly equipped dairy all the processes are fully explained and put in practice by the students.

(5) **Cheese Making**—The method of making Cheddar cheese is fully discussed and applied in the dairy; but the methods of making several other kinds of cheese are studied.

(6) **Dairy Bacteriology**—The danger, use and control of bacteria in dairy work.

(7) **Creameries and Cheese Factories**—Their organization, construcstruction and equipment. The dairy lectures are supplemented by practical work in milk testing, butter making and cheese making in the college dairy. Students who successfully complete the two years' work in dairying, and have spent one year as first assistant in a factory, will be recommended as head butter or cheese makers.

AGRONOMY

1. **Crop Production**—The term's work consists of a study of the principles underlying reproduction, germination and growth in farm crops; also, a discussion of plant enemies, such as smuts, rust, etc., with methods for their destruction.

2. **Soil Physics**—This course comprises a review of the origin, formation and classification of soils, and the influence of their physical condition upon the growth of plants.

3. **Farm Crops**—A study of farm crops taken up under an agricultural outline—grain crops, root crops, forage crops, sugar and fiber crops—peculiarities and methods for their successful growth.

4. **Soil Fertility**—A study of soil fertility, with methods for its maintenance.

HORTICULTURE.

Fruitgrowing—The growing, harvesting and marketing of apples, plums, pears, peaches and cherries will be carefully studied. The propagation, growing and marketing of strawberries, raspberries, currants, gooseberries, etc., will be considered.

Horticultural Methods—The methods of crossing plants and of growing plants from seeds, cuttings, grafts, buds, etc., are studied.

Landscape and Vegetable Gardening—In landscape gardening particular attention will be given to the study of plans for laying out and planting farm homes. The growing and marketing of common vegetables, hot-bed construction and management, planting, transplanting, watering, etc., are features considered in vegetable gardening.

Forestry—Conservative lumbering, as practiced in the United States; the effects of forests upon agricultural lands; and the methods of preserving our forests, are studied in this course.

OTHER SUBJECTS.

Economic Entomology—The life history and habits of the different orders of insects will be treated in lectures, so as to enable the student to appreciate the reasons of adopting the various methods for restraining injurious insects.

Apiculture—The life history of the honey bee, as it applies to practical apiculture, will be discussed. The selecting of a site for an apiary, management of bees, harvesting and marketing honey will be taught in this course. These subjects will be taken up from the beginner's standpoint.

Irrigation—Only the practical features of the subject will be discussed. By means of lectures, models, diagrams and assigned reading, an effort will be made to give the students some knowledge of the proper manner to divert, convey and apply water for irrigation purposes.

Business Forms and Customs—Will be taught through lectures and recitations on laws of business, commercial paper, contracts, notes, deeds, mortgages, and such facts as each one should know who expects to have business relations with his fellow men.

Farm Bookkeeping—A theoretical-practical course in farm bookkeeping has been especially prepared for courses in agriculture. Transactions will be written up by the students in a farm ledger, the book balanced and ruled up, and statements made showing results of the various operations. The work will require about one hour a day.

Shop Courses—The work in the shops for the agricultural students is especially adapted to their needs. For a general account of the work, see the courses in joinery, wood turning, pattern making and forging in the winter course in engineering, page 116 of this bulletin.

WINTER COURSE IN ENGINEERING.

JAMES M. HAMILTON, M. S., (Union Christian Col.),
President.

WILLIAM D. TALLMAN, B. S., (Univ. of Wis.),
Professor of Mathematics.

WILLIAM M. COBLEIGH, A. M., (Col. Univ.),
Professor of Physics.

JOSEPH A. THALER, E.E., (Univ. of Minn.).
Professor of Electrical Engineering.

GEORGE B. COUPER, M. E., (Univ. of Minn.),
Professor of Mechanical Engineering.

VICTOR K. CHESNUT, B. S., (Univ. of Cal.),
Professor of Chemistry and Geology.

CHARLES S. DEARBORN, B. S., (Kansas State Agri. Col.),
Assistant Professor of Mechanical Engineering.

HOMER G. PHELPS,
Principal of Business Department.

MRS. MABEL KINNEY HALL, Ph. B., (Oberlin Col.),
Instructor in Public Speaking.

The winter course in engineering will open November 14, 1905, and the year will close March 30, 1906. The course will occupy two years, of eighteen weeks, and is offered to meet the demand for a short, practical course in engineering. It is intended for those who wish to become practical operating engineers in charge of power plants, involving the installation, care and operation of steam, electrical and other machinery, and for those wishing special work in mechanical drawing or shop work in wood or metal. Students completing the work in a satisfactory manner will be granted a certificate.

The equipment of the college shops and laboratories will be used in the work of this course. The power and heating plant of the college contains a 125 H.-P. water tube boiler, an 85 H.-P. return tubular boiler, a 60 H.-P. steam engine, and a 40 K.-W. dynamo. There is a full equipment of feed pumps, injectors, gauges, thermometers, tanks, scales and indicators, for making complete engine and boiler trials. Besides these, the college has five steam engines of different types, including a 15 H.-P. compound Advance traction engine, and a 16 H.-P. Russell traction engine. A 50 H.-P. condenser will be installed this year. The electrical equipment consists of over a dozen dynamos and motors, of different sizes and types; an assortment of arc and incandescent lamps, primary and storage batteries, and a complete outfit of electrical measuring instruments.

The shops are well equipped with modern tools for each line of work.

The student, to take this course, must be over seventeen years of age. A general fee of $4.00 per year will be charged, and fees covering cost of material used, viz: First year's shop work, $5.00; second year's shop work, $4.00.

SCHEDULE FOR WINTER COURSE IN ENGINEERING.

FIRST YEAR.

First Term.		Second Term.	
Arithmetic	3	Arithmetic	3
Chemistry (Lectures)	1	Chemistry (Lectures)	1
English Composition	3	English Composition	3
Steam Engineering	2	Steam Engineering	2
Mechanical Drawing	6	Mechanical Drawing	6
Wood-working	9	Forge Work	9
Engine and Boiler Practice	6	Engine and Boiler Tests	6

SECOND YEAR.

First Term.		Second Term.	
Algebra	3	Algebra	3
Physics (Lectures)	1	Physics (Lectures)	1
Business Forms	2	Business Forms	2
Bookkeeping	3	Bookkeeping	3
Electricity (Lectures)	2	Electricity (Lectures)	2
Mechanical Drawing	6	Mechanical Drawing	6
Machine Work	12	Machine Work	12

Steam Engineering—This subject will be treated in such manner as to make it of interest to engineers of some experience as well as for beginners. The class work, by means of text books and lectures, will discuss the theoretical side of the subject; but will be confined to those phases of it that have practical applications. It will thus give an opportunity for men of some practical experience to gain knowledge of the subject they would not ordinarily get in practice. On the other hand, the practical work which will be given in the engine room will enable the beginner to get some useful experience and, at the same time, apply the knowledge obtained from the class work. The different parts of a steam plant will be taken up and discussed in detail, and the purpose for which each is intended. The proper care of boilers, with regard to safety and economy, will receive special attention. Actual tests for consumption of fuel will be made, giving the student the necessary knowledge to test a boiler and determine the best fuel to use. The steam engine indicator will be used for setting valves and for determining the horse power of engines. Attention will be given to fitting students to take the examination for engineers' licenses.

Electricity—Two lectures per week, on the elementary principles of electricity, methods of wiring, the care of batteries and the practical management of dynamos and motors.

Mathematics—Will be given throughout the course. The work will begin with arithmetic, at the point found necessary for the majority of the class. The subject will be treated in such a way as to meet the needs of the student in his special kind of work.

Mechanical Drawing—The beginning work is such as to give a practical knowledge of the use of drawing instruments. The student then takes up actual working drawings from plates and models. After the elementary principles are understood, it is very easy for a person of any mechanical ability to make simple drawings that will assist him in laying out and performing his work. During the course the work will be carried along far enough to enable the student to make such drawings as house plans, parts of machinery that have to be repaired, also designs of new machinery. The method of tracing and blue printing will also be given.

English Composition—As given in this course, will be similar to that of the preparatory courses.

Business Forms—Will consist of lectures and recitations on laws of business, commercial paper, contracts, notes, deeds, mortgages, and such facts as each one should know who expects to have business with his fellow men.

Bookkeeping—A short course in elementary bookkeeping for private use.

Elementary Physics—One lecture per week, with experimental illustrations on subjects of importance and interest to men in practical pursuits and to students of engineering problems.

Elementary Chemistry—One lecture per week, illustrated by experiments. An attmpt will be made to interest the students in the more practical and fundamental principles of chemistry, especially in those lines which are of importance to engineers.

Joinery—The care and use of carpenter's tools and woodworking machinery.

Wood Turning—Spindle, face plate and chuck turning, and finishing.

Forging—Iron and steel forging, hardening, tempering, annealing and case-hardening.

Machine Work in Metals—Chipping, filing, turning, facing and boring (straight and taper), planing, milling, finishing, fitting, machine grinding, etc.

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*Dropped from the College in June, 1906.

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